THE WORKING OF THE RAILROADS

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The Working of the Railroads

The Working of the Railroads

BY

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LECTURER ON

TRANSPORTATION AT JOHNS HOPKINS UNIVERSITY

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Preface

THAT portion of these lectures which treats of the organization, the work and inter-relation of the different departments of a railroad company, is based in the main upon the writer's experience and observation while in the railroad service, supplemented by the information which officers of acknowledged eminence in active administration have courteously and freely given. It is believed that a large part of this information finds accessible expression for the first time.

It is hoped that this volume will aid in giving an accurate conception of the underlying principles of railroad practice to

(a) Those whose votes elect legislators and ultimately control legislation;

(b) Those in the railroad service who would gain a more extended view of its different phases than is afforded by contact with their own immediate duties;

(c) Young men whose studies include the transportation industry, many of whom may make it their vocation.

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Preface

While a number of excellent books treat exhaustively of one or more specific branches of railroad construction, operation or administration, or of the legal or economic aspects of the subject, there is not, so far as the writer knows, a publication which occupies the field in which this volume is offered. It is offered, however, not as a treatise but as a primer.

The contents of this book are constituted, with some modifications, of the lectures delivered by the author in the Course on Transportation at Johns Hopkins University in the Spring of 1906.

Maryland Club, Baltimore,
October, 1906

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I

THE TRANSPORTATION FUNCTION

A FIRST precept of the old time mental philosophy was to study a thing, first, in relation to its surroundings; second, as a whole; third, the relation of the parts to the whole, and of the whole to the parts.

Following that injunction of the school room, this lecture will be devoted to an examination of the relation that a railroad bears to its environment, and that the railroads as a whole bear to their environment as a whole.

A railroad performs the function of transportation, the carrying of substances from one place to another. That is, a railroad does that which is done by all positive force: it generates motion, and motion means the passing of substance from one place to another. All progress is derived from motion. As the atoms unite in molecules there is motion; that is, there is transportation, with the result that the composition of substance takes on variety. As the nebulae whirled into spheres and the spheres into solar systems, the movement of substance was marked by cosmic

advance: the upheaval of the mountains and sweeping aside of the waters brought variety to the surface of the earth; the reaction of the sun's heat that brought the palpitation of organic matter and the falling of the rain drop that gives it nourishment, all exemplify motion, transportation caused by primary force. This progress of the cosmos, of the earth, of life, has been characterized throughout by the bringing together, and the progressively more intricate fusing of different kinds of substances.

That that motion effected through human agency which we designate as transportation furthers and continues this progress is not difficult to perceive. The bringing of food, of clothing, of implements by canoe or trireme, by elephant or caravan, meant the placing at the disposal of the recipient that which supplied his elementary needs, leaving him a surplus of time and energy to do a greater variety of things, to multiply his ideas. Between the force which marshals the molecules and the planets and invests the organic tissue with life, and the force which fashions the canoe, impels the trireme and drives the horse, there has developed the human mind. In the history of its development nothing is more impressive than the increasing degree to which it has

utilized the forces that surround it, in the function of transportation, in the movement of merchandise in greater variety and larger quantity over longer distances in shorter time. Thus increasing numbers of persons in increasing degree have been provided with the things which supply their material wants. As these wants have been supplied with decreasing absorption of their energies, they have been enabled to extend the grasp of mind that leads to a fuller life.

Through the application of steam as a motive power has increased in the last century, in greater degree than throughout all previous time, this volume and variety of things moved, this rapidity of movement, this lengthening of distances traversed. It is no longer the expensive articles of luxury that constitute the greater portion of commerce; but materials of all kinds, even the heavy, crude and unhewn, are brought together from the most widely separated localities and wrought into the greatest number of finished forms, which are distributed over the broadest territory to the greatest number of people. That is, the improvement in and cheapening of transportation results in the increase of production. The ease of transportation also facilitates emigration and immigration, which tend to distribute labor where it is needed,

and in perceptible measure to equalize the wages of the laborer.

This has facilitated the localization of industry, the bringing together in a particular locality of the agencies of production best suited to that locality, and the distribution of the products therefrom to extending markets. Thus have been built up the great traffic currents of fruits and vegetables from Florida and Georgia on the one side and Arkansas and Missouri on the other; of semi-tropical fruits from California and from the West Indies; of wheat, corn, oats and barley from the fields of the West to the markets of the East and Europe; of cotton from the South and of manufactures from the New England and upper Atantic States throughout the entire West and South; of furniture and implements from the Central States; of lumber from the far Northwest and the far South to supply the demands that can no longer be met by the denuded forests of the East.

It is evident that with this localization of industry has grown an increasing dependence of the entire population upon transportation: there is not now the self-sufficing community of our forefathers. That is, the transportation structure tends more and more to become not only an integral

but a vital part of the social structure; the transportation function to be inseparably interwoven in that complexity of function by which civilization is manifest. In that all progress arises from motion this is necessarily true. This interweaving in the United States is shown by the following statistics of railroad development obtained from the reports of the Interstate Commerce Commission:

YEAR	MILEAGE	RAILROAD EMPLOYES	POPULATION
1870	52,898	163,303	38,558,371
1880	93,671	418,957	50,155,783
1890	163,597	749,301	62,622,250
1904	213,904	1,296,121	81,249,122

That is, in 1870 there was one mile of railroad for every 729 persons; in 1880, one mile for every 535 persons; in 1890, one mile for every 388 persons, while in 1904 there was one mile for every 380 persons. In 1870 there was one railway employe for every 236 persons; in 1880, for every 111 persons; in 1890, for every 84 persons, and in 1904 there was one railway employe for every 66 persons: that is, one railway employe for every 12 adult males in the United States.

The development of the transportation function is not only working unceasing changes in the industrial mechanism, but is affecting all that pertains to war. The use of the railroads on a considerable scale in the war between the States made possible a rapidity of operations before unknown. By the aid of the Siberian Railroad, Russia recently conducted a war four thousand miles from the centre of population and base of supplies, an achievement to which under the conditions of their day neither a Hannibal nor a Napoleon would have been equal. In the designs of its stations the most militant nation of Europe gives the first consideration to the facility for the massing and the movement of troops.

That the railroads may contribute, as they do, to supplying the needs of the entire people, it goes without saying that they must make tremendous drafts upon the energies of the people; that is, that they must utilize a vast proportion of the products of that energy. There is no occasion for surprise therefore that the railroads of this country are the largest users of steel and the greatest consumers of coal: the requisitions they make upon other industries, from those that shape the products of the forests, to the printing houses, make them the largest patrons of the mills and factories. The

nation, the states, and the municipalities, counties and townships throughout this country, derive taxes in greater amount from the railroads than from any other one industry. Next to the bonds of the various governmental bodies their securities afford the most desirable investments in the United States; they constitute a great proportion of the resources of life and fire insurance companies, and are largely represented in the assets of educational institutions.

An indication of the extent to which the railroads contribute to and draw upon the energies of the country is given by these figures:

YEAR	GROSS EARNINGS	OPERATING EXPENSES	TAXES	INTEREST AND DIVIDENDS
1880	$615,401,931	$360,208,495		$184,981,739
1890	1,178,644,696	692,093,971	$31,207,479	308,571,315
1904	2,024,555,061	1,338,896,253	61,696,354	465,872,674

That is, in 1880 for every dollar received by the railroads they paid out 58 cents for wages and merchandise; in 1890, 59 cents and in 1904, 65 cents. In 1890 for every dollar that they received the railroads paid out 02.64 cents in taxes and in 1904, 03.04 cents in taxes.

From 1880 to 1903 the passenger mileage per capita increased from 114 to 260, the ton mileage

per capita from 645 to 2155. There is hardly a commodity and not a day's labor of any kind that will not purchase more transportation now than then. It will be perceived from this that the railroads contribute in constantly increasing degree to the energies of civilization, while making a constantly decreasing drain upon those energies per unit of service rendered to civilization.

It will also be perceived from a survey of the field of transportation as a whole, that in the United States the performance by the railroads of this function, reduces to a negligible proportion the amount of transportation effected through all other agencies. Horses and wagons, upon which the entire burden of land transportation once rested, are now used only to a local and limited extent. When it is reflected what an Alexander and a Caesar accomplished with such rude agencies as these, one is appalled at the thought of what an instrument a railroad system would be to further an imperial ambition to-day. We understand how an island like Great Britain penetrated by estuaries and with no long land-routes, could have attained by the aid of sailing vessels a considerable industrial and commercial development before steam was known. We appreciate how the tradition of the water-ways

has impaired the development alike of the railroads and of commerce in France and Germany, where heavy commodities are still carried by river and by a netted canal system. But in the United States we see the railroads carrying the heaviest and bulkiest of commodities, in thousands upon thousands of cars, having a capacity of fifty tons or over, while but two or three hundred in the German Empire will carry more than fifteen tons, we see this heavy freight moving by rail almost to the exclusion of marine transportation, except on the ocean, the Great Lakes and the very largest rivers.

The care of the water-ways has however ever been a governmental function. In the days of triremes and caravels, harbors had to be maintained by the aid of the government or not at all, and hence that custom in pursuance of which the government, wisely no doubt, still maintains harbors and signal lights, dredges channels and builds locks. Of these expenditures on their roadbed and for maintaining their right of way, vessel owners do not have to take account: they do not enter into their balance sheets. This traditional fatherly care of the water-ways has led to queer excesses. Everybody knows what the river and harbor bill is, and what it stands for at Washington. An extreme

example was brought to light by a landscape photographer, who in searching for new subjects for views, once went down to Alabama to take some photographs of a river on which an enormous appropriation had been made for the improvement of navigation. He found a brackish stream running through a morass. A nearby resident said that if the government would pay to him the amount appropriated for improving the river, he would agree out of the appropriation to build a railroad the entire length of the river, equip it to haul all the freight that would be offered to it, buy all the freight, and put the remainder out at ordinary interest, which would yield enough to operate the railroad, pay for carrying all the freight, and leave him a handsome income besides. The influence of the coastwise steamers, of those on the Great Lakes and the great rivers, has however a very important effect upon the movement of traffic, and the revenue which the railroads derive therefrom.

Suppose we now consider what is meant when we say "a railroad." The term obviously designates a roadbed of rail in contradistinction to a turnpike, and the fact that the road is laid with rails was the only distinction that was originally intended between it and the turnpike; those who

used the railroad were to own their own vehicles and pay toll for the use of the road, just as toll was paid for the use of the turnpike by those who drove wagons over it. It was at first not known what would be the motive power of the railroad: the main point was that because of the decreased friction by the running of wheels on rails, greater burdens could be hauled with less effort. Somewhere is an old print of a scene at the Baltimore Chamber of Commerce, one evening in the twenties: there is shown a small car with rollers placed on rails, and a cord runs from the car over a pulley in the ceiling: a venerable citizen is in the car in a gale of glee at the perception that it moves at only a touch upon the cord when it is standing on the rails, whereas it required considerable effort to move the car and its passenger by a direct pull upon the floor. Even after the rails of the Baltimore and Ohio Railroad were laid from Baltimore to Ellicott's Mills, it was undecided whether to use horses as the motive power or sails, with which experiments were actually made.

But it was soon learned both in England and the United States, that vehicles appropriate for the rails and the steam engine had to be of peculiar construction, their size and expense making it impracticable for the casual shipper to own either

cars or coaches: this tended to concentrate their ownership in the railroad companies and this with certain exceptions is the custom now.

Therefore a railroad, even in a restricted sense, embraces not only the road, but the equipment and the necessary stations for both freight and passengers are clearly included. But we also mean much more.

In accordance with that fundamental law, under which the extension of function brings an increase in the size and complexity of structure, a railroad company usually finds it necessary to maintain its own telegraph lines, its own repair and often its own construction shops, its own elevators, its own docks, tugs and ferries, to say nothing of its own steamboats. A large railroad company may own forests for its tie supply, impound water in lakes to feed the boilers of its locomotives, and operate coal mines to supply their fire boxes.

Therefore when we speak of a railroad, we ordinarily mean to designate not only the rails and rolling stock and stations, but an elaborate and ramifying structural entirety necessary to and coordinated in a series of functions that are centered upon the performance of the function of transportation: and the entity known as a railroad

company embraces an organization that in its working and administration comes in contact with every phase of human activity.

For in the laying out of a railroad are required the services of civil engineers; in its construction, architects and contractors, bridge builders, carpenters and masons; in its maintenance, civil, mechanical, marine and electrical engineers; in its operation, masters in the detail of transportation and handling of men; in the conduct of its traffic, men who must know products of whatever kind, their markets and the currents thereto; men who must know the peculiarities of those who travel, and the details of all passenger routes. All of this necessitates in administration a complicated and delicately adjusted accounting department; a treasury department in touch with all that pertains to finance and the money market; a legal department to look after the matters that come or are likely to come to the courts, the adjustment of taxes, the conformity of the corporate organization to the requirements of the law, to supervise the form of and often to negotiate contracts; and there must be above all a man of wide general information, keen and sane, to keep continual guard over the affairs of the company, to watch the tides of industry, commerce, politics and finance, and the currents

and eddies of public opinion, in order that the relation of the company as a whole may be kept as nearly as possible in equilibrium with the ever dynamic social structure throughout every cell of which its bloodbearing vessels go. This likening of the railway system to the circulating system of the body is no idle metaphor. The tissues that are the very warp and woof of the body owe their existence to the channels through which flow the blood currents that bring nutrition and carry away waste: the men and the women that are the cells of which the tissue of society is formed could not exist, were there not brought to them the nutrition for mind and body, that under the conditions of to-day, flows through the arteries that we designate as the railways.

In the discussion of the relation that a railroad bears to its environment, we have necessarily given some attention to what a railroad is as a whole. In the enumeration of that which we mean to designate when we say a railroad, and of that which is embraced by the entity known as a railroad company, we have approached to a comprehension of what constitute its parts. We may be helped, however, in our further consideration, by coming to an understanding of how a modern railroad has come to be what it is, that is, by reviewing the steps and

processes of its evolution. To this end, there can be nothing better than to trace the history of that railroad, which was really the first deserving the name to be begun in this country, which almost alone of the great railroad companies of the United States, has preserved unchanged its corporate title, which in its record exemplifies all that is worst and all that is best in railroad administration, which in its changing fortunes has been indissolubly linked with the history of the nation, of this city and of this university.

On February 12, 1827, a number of citizens of Baltimore met to devise some means of transportation that would enable the city to regain its trade with the West, that was being diverted to New York and Philadelphia, and finding its way in larger measure for export through New Orleans. The result was an application to the legislature of Maryland for an act incorporating a joint stock company to be styled the Baltimore and Ohio Railroad Company, the capital stock to be five million dollars, subject to increase. The rules and regulations adopted in 1829 provided for and defined the duties of a president, chief engineer, superintendent of graduation and masonry, superintendent of construction, architect and superintendent of depots, an auditor of accounts and superintendent of trans-

portation, a treasurer and a superintendent of machinery. A road was decided upon from Baltimore along the valley of the Patapsco, thence to the Point of Rocks near Harpers Ferry, and along the Potomac to Cumberland: ground was broken on the Fourth of July, 1828, by Charles Carroll, of Carrollton, in the presence of a large assemblage. It was estimated that the first stretch to Ellicott's Mills would cost seventeen thousand dollars per mile, which included the use of oak rails in the outlying regions, iron rails not being obtainable for less than ninety dollars per ton. It was soon found that contractors were inefficient, and that insubordination sometimes arose from over indulgence in ardent spirits by the workmen. By 1830, the invention of a combined cylindrical and conical wheel facilitating the turning of curves, removed all doubt of the availability of the steam engine. The chief engineer urged the use of springs on cars, especially if the motion be rapid and stated that the first track was wooden string pieces on stone blocks, surmounted with an iron rail, all laid lengthwise, but that on the higher embankments, it had been found advisable to support the string pieces by timbers laid crosswise. He stated that a speed of ten miles an hour could be made with horses, but describes a locomotive constructed by Peter Cooper, having

a single working cylinder of three and one half inches in diameter, placed on wheels thirty inches in diameter, which went to Ellicott's Mills at a speed varying from five to eighteen miles per hour. By 1831, it was found that the cost of the road had averaged twenty-seven thousand dollars per mile, and the trickery of a contractor, who incited the prejudices and passions of the credulous laboring men against the company, had brought on a labor riot costing some six thousand dollars. At this time the locomotive had attained the stage of doing the work of forty-two horses and twelve men. It had been discovered that the products of the interior that would have "fallen and rotted where they stood" had been transported to the seaboard and marketed with a profit; likewise products of the seaboard, some of little value, that would not have been transported under former conditions, had been taken to the interior—thus "the profits of the road had been increased from sources that were not thought of." By 1833 the company decided to build a line to Washington, and to build and repair its own locomotives, erecting suitable buildings for that purpose. In 1834 it was announced that the granite viaduct over the Patapsco with eight arches of fifty-eight feet span, would be the largest structure of the kind in the United

States; that four locomotives were in service and ten under way; that it had been decided to employ an eight-wheel passenger car, invented by Ross Winans; that there were in service thirty-four passenger, and one thousand burthen cars—this was the designation of freight cars for many years. At this time the charge for freight was six cents per ton per mile westward, and four cents eastward. Almost from the opening the road had paid dividends, but heavy and unexpected expenditures for regrading and rebuilding, caused the dividend to be passed in 1833: in 1835, the remunerative traffic that came to the Washington Branch immediately upon its completion, allowed the resumption of dividends, after the charging off of seventy-five thousand dollars for deterioration. In 1836, it was determined to extend the road to Pittsburgh and Wheeling, the State of Maryland and the City of Baltimore each subscribing three million dollars for that purpose. The operation of the construction and repair shops was turned over to Ross Winans. It had been found necessary to renew the wooden string pieces with heavy iron rails, and the Board was obliged to make an assessment of five dollars per share on the stock. It was stated that the B. & O. had not proved profitable as had other railroads, because it had not been completed

through to the West, and because its tariffs were lower. In 1837 further instalments of capital were called for, and the general feeling of the community is indicated by the appointment of a committee of five, to investigate the affairs of the company. In 1838 the company took over the shops, and resumed the construction and repair of locomotives. In 1839, to meet its subscription of three million dollars, the City of Baltimore issued a special stock, for which, however, no buyers could be found, but against which orders were finally issued, which the citizens of Baltimore were urged to receive in payment for indebtedness of the company. To meet the subscription of the State, bonds were issued which were placed with Baring Brothers and Company of London for sale. One result of the investigation of the committee of five, was the reorganization of the administration of the company, in accordance with a plan formulated after an investigation of the working organizations of the railroads in New England. Instead of the numerous officers immediately concerned in construction, as provided for in the original organization of 1829, this new plan provided for a master of transportation, a master of the road and a master of machinery, thereby approximating closely to the subdivision of what is known as the operating

department of to-day. The traffic department and the accounting department, however, had not only not evolved, but were hardly in embryo, the supplying of tickets, publishing of rates and returns for freight, being divided in a peculiar way between a secretary and treasurer. The secretary, for example, used to go down to the Baltimore station every day, with a tin box containing tickets: in the evening he would go down again, carry back to his office the tin box containing the unsold tickets, and the money for those that had been disposed of.

The connection with Baring Brothers, established by the sale of the State bonds, led in 1850 to another of a long series of steps in European financing. As a fund for rails for the Wheeling extension, bonds were issued and placed with Baring Brothers and Company. In 1851, steps were taken toward an extension to a connection with Cincinnati. In 1854 a convention of the New York and Erie, Central New York, Pennsylvania, Hudson River, and Philadelphia and Wilmington roads was held in New York, for the purpose of producing uniformity in the classification of their respective tariffs and advancing the rates: the subject of free passes was discussed, and it was agreed that all such be abolished.

For the next several years the operating expenses of the company were very high. The extensions toward the Ohio River were a constant drain; its traffic had relatively fallen off, and finally the panic of 1857 severely hampered its activities. In 1858, John W. Garrett, the son of a Baltimore banker, who was largely interested in the road, was elected to the presidency. The working expenses were decreased in one year from sixty-five per cent of the gross receipts to forty-six per cent, and then to forty-one per cent, a result so marvelous, that it attracted attention throughout both Europe and the United States, and Mr. Garrett was pronounced the most efficient railroad administrator then alive. Thereby hangs a gradually unfolding tale. Mr. Garrett also inaugurated a policy of expansion: liberal outlays were made for improving the property, for completing the long delayed connection to Pittsburgh, to assist in the establishment of a line of steamships between Baltimore and the ports of Europe. This policy was interrupted for the four years beginning with 1861, when the road was repeatedly destroyed and as repeatedly rebuilt, as it passed into the possession of the Confederate or the Federal troops; and the difficulty of restoration and operation during the year after the war was

enhanced by extraordinary freshets. With the resumption of commerce, the policy of expansion was resumed. The road and its connections were extended to Cincinnati, Sandusky, St. Louis, Pittsburgh and Chicago. Steamboats were purchased, docks and grain elevators constructed, hotels were built as mountain summer resorts, interest was taken in a dry dock at Baltimore, and a stock yards company organized. The expenditures for these various purposes were carried in the surplus fund, the magnitude of which was heralded to the European investors, who were always ready to take new issues of securities. There were repeated loans for millions of dollars. The company also established and operated its own express company, telegraph company and sleeping car company.

The falling off of traffic, and intensity of competition between the trunk lines, that followed the panic of 1873, again injuriously affected the revenue of the railroad, but its reports continued to show large additions to the surplus. When it was desired to obtain additional funds, bonds were always issued instead of the capital stock being increased. Interest on bonds has always to be met, whereas dividends on stock can be passed. It was announced, however, that the retention of the stock capitalization at less than fifteen million dollars

was an evidence of conservatism, as the continuance of semi-annual dividends of five per cent was thereby permitted. It is widely known that over eight million dollars of this capitalization was held by interests which would have lost control of the property, had there been issues of new capital stock instead of bonds.

Upon the death of John W. Garrett in 1884, he was succeeded in the presidency by his son, Robert Garrett, who continued the policy of expansion. Not until this year did the Baltimore and Ohio Railroad have a General Manager, one man directly responsible for the operation of the road, the maintenance of way and of the machinery. The company was the first in the United States to establish a relief department, through which contributions both by the company and employes provided a fund for the payment of accident and death benefits, and subsequently for pensions to the superannuated; this department also serving the purpose of a building and loan association.

The heavy expenditures incurred under the new regime, especially in extending the line from Baltimore to Philadelphia, and the attempts to gain an entrance into New York, necessitated the raising of additional funds in vast amounts. It occurred at last to the European investors that it

might be well to make an investigation of the company's boasted surplus, before making further advances. It was then ascertained that throughout the administration of John W. Garrett, expenditures that should have been charged directly to the operation, and deducted from the net income—thereby making the percentage of operating expenses much higher than the reports had shown—had regularly year by year, been charged to the capital account and included in the surplus; that there was nothing to show for them but the figures in the books. It was ascertained that in the record of the assets of the company were included millions of dollars, that had been advanced for the construction of branch and subsidiary lines, largely spent in ways that could never yield a return, and therefore should have been charged up as a loss, instead of to the surplus. It was ascertained that in the record of the assets had been carried locomotives, cars and other property, that in large part had been destroyed or disabled and never replaced; that docks, warehouses and other structures had been carried on the books at their full valuation, although they had deteriorated from year to year. What then happened is within the memory of men still young. The stock of the company that for a generation had been considered one of the safest of

investments, fell to almost nothing. The telegraph company was disposed of to the Western Union; in quick succession the B. & O. Express went into the hands of the United States Express Company, and the sleeping car company into the hands of the Pullman Palace Car Company.

In 1888 there came to the presidency Mr. Samuel Spencer, who made an effort to reduce the valuation of the company's property, as carried on its books. Although the cut that he made was not nearly so drastic as the circumstances really demanded, it was more than the owners of the property were willing to accept. Had the accuracy of Mr. Spencer's position been frankly recognized, and taken as a basis of action, the next decade of the Baltimore and Ohio Railroad might have been of steady recuperation instead of deepening disaster. But wounded in pride and pocket, the stockholders continued in that self-deception, which in another half dozen years allowed the ravages of the weather to wear the paint off the passenger cars, so that the very name of the road was unrecognizable; which brought the service to such a pass, that often a train could not be sent out from Camden Station, until another had arrived, that the lamps and drinking glasses might be obtained from it; and finally it was proposed in all seriousness, to the

directors of the company, that the passenger service be abandoned altogether. We all know what has happened since then. The broad grasp of John K. Cowen, and the excellence of method introduced by L. F. Loree, have made possible the Baltimore and Ohio Railroad of to-day, that in its structure, its administration and its prosperity, is admittedly in the first rank of the railroads of the United States. In its service are still a few who were in its ranks even before the Civil War: now and then on leaving Camden Station, one is met by one and now another white-haired conductor whose courtly manner touches a chord of the olden time.

During the period covered by this hasty retrospect, which will furnish many a text for this course of lectures, the principles that underlie the location and construction of a railroad, have been reduced almost to a science. The maintenance of way, the construction, methods of use and repair of rolling stock, have been studied under various phases and in elaborate detail. Through incessant experiment has been devised a code of orders and signals governing the running of trains, that is standard for the United States. The accounting officer has developed from a mere bookkeeper into a spiritlevel, that discloses every variation in the status of a property, and the effectiveness of the

administration. Despite occasional and exceptional monstrosities of manipulation that speculative promoters ever find more difficult to carry through, railway finance has attained a basis of great solidity. Instead of attention to traffic being a minor adjunct of the duties of some operating or other officer, the traffic officials of to-day must know the sources and the costs of production, the places of and prices at market of all commodities, and must bend their energies toward obtaining the utmost traffic for their lines; this means the supplying of the greatest number of people with commodities in the greatest variety and quantity. Great experience has been gained in the selection, treatment and discipline of employes, who, because of the extent to which the safety of life and of property depend upon their careful performance, are obliged to be temperate and courageous; to work in the spirit of the soldier and the patriot. Among the officers has grown a professional spirit akin to that of the officers of the Army. Among officers and employes a conspicuous characteristic is a mental veracity, inground into habit from the matter of fact necessity to always perceive things as they are. Their actions must be based upon their perceptions: if these are false the result may be disaster. Between the different departments charged

with the various functions, has developed a system whereby information is exchanged and functions correlated. Under the authorization of Congress the different railroad systems of the United States exchange traffic one with another. Although each owes its corporate existence to an Act of a specific State, the greater measure of their performance is in the movement of traffic that crosses State boundaries. The phases of railway administration that have been outlined and the various problems to which they give rise in the following lectures will be considered in detail as they exist to-day.

This introductory lecture would not be complete, however, were there not a word in regard to the use of electricity, which in the last ten years has been applied in increasing degree to transportation. Although in many places the steam railroad companies antagonized the electric lines, it is now recognized that the latter are valuable feeders, and that by relieving the steam railroads of the short distance passenger traffic, they leave them freer for the movement of the through passenger, express and mail trains, and of freight trains which are too heavy for extended movement by electricity. With the extension of the electric lines the population and the intensive activity of any region

tends to increase and in consequence the traffic carried by the steam roads increases also.

Although the claim of the more enthusiastic that electricity will in the course of time entirely take the place of steam has not as yet an adequate foundation, its substitution for steam progresses. Here again the Baltimore and Ohio Railroad was in the lead, the first application of electricity as a motive power for heavy trains having been in the tunnel between Camden and Mount Royal stations. The New York, New Haven and Hartford Railroad is electrifying many of its suburban trains. The New York Central will use electricity for all trains between Grand Central Station and the suburban stations within fifty miles thereof, and electricity will be the motive power in the tunnels of the Pennsylvania Railroad under the North and East Rivers and Manhattan.

II

CONSTRUCTION AND OPERATION

Of the early railroads few if any, were built primarily with the expectation of obtaining profit from their operation. The Baltimore & Ohio was built to draw traffic to the City of Baltimore; the Pennsylvania State Line of improvements, the predecessor of the Pennsylvania Railroad, to preserve the stability of the City of Philadelphia; the Cincinnati Southern to give Cincinnati an outlet to the South that would be independent of Louisville; the early granger roads to provide a way to the markets for the grainfields of the Mississippi Valley; the transcontinental roads were especially fostered by the Government, that they might bind the Pacific Coast to the Union. In many of these roads the money first contributed has been lost, and some of them have been reorganized time and again; but they have nearly always effected the desired purpose of developing the regions which they have traversed, and the communities which they have served.

Leaving now out of account the exceptional railroad that has been built to be "sold out" to

another railroad, and the railroad built for the profit that might be made by the construction company, it is quite true as a rule, that at this time the inception of a railroad requires a degree of serious attention to the economic factors, that was impossible at the time when the amount of traffic that would be developed by a new line was an unknown quantity. New construction is nowadays largely of additional lines to relieve those in existence of a portion of their burdens; to eliminate curves, to reduce grades, and in other ways to expedite and make more economical the movement of traffic; of branches to increase main line traffic; of branches to develop mineral lands; of extensions to place a railroad on a parity in competitive territory with other lines. One or both termini are usually clearly defined by the commercial or physical conditions that prompt the construction, but there ordinarily remains a considerable range of choice as to the exact region or portion of a region through which the line shall be laid, and its definite location must be planned and plotted with the highest degree of exactitude.

It is the duty of the engineer charged with the laying out of a line, to consider what will probably be gained or what will probably be lost to the gross receipts of a road by taking one or another route; by

building the line to touch certain cities, towns and other traffic sources, or by reaching those traffic sources by branch lines in order that the through traffic may not be put to the expense of a haul over a longer line than necessary; what will be saved or what will be lost in operating expenses, by choosing one route with higher or another with lesser gradients; one route with a greater or another with a lower curvature. He must so balance the considerations between probable traffic and probable expense as to obtain the greatest probable quantity of the most remunerative traffic. As in all other investments the aim should be to obtain that which will fulfill the desired purpose, without spending more money than is necessary to that end, and without stinting expenditure in a way to impair the attainment of that end: that is, there must be no waste either in spending money or in saving it. It follows, therefore, that the first and most important duty of those charged with the construction of a railroad is to determine with definiteness what ought to be done. It will be seen that a right decision in this respect, is a matter of overwhelming importance, when it is remembered that with the railroads in the United States, where their results depend entirely upon their successful operation, the margin

of profit is very small. We are so accustomed to hearing totals expressed in millions of dollars, that we are blinded to the fact that on all except a few roads very securely established, a very moderate percentage of difference in either the first cost, the operating expenses, or the volume of revenue means the difference between success and failure.

After the preliminary consideration as to building a railroad the next step is the reconnaissance, an inspection of the area which it is proposed that the line shall traverse. There are engineers who have what is called "an eye for the country," a seemingly intuitive apprehension of the features of a country traversed even for the first time: this, however, is only a gift which may be developed or even acquired by care in observation. That his reconnaissance may be effective, an engineer should know with the economic features of the region, the relation that different kinds of construction on alternate routes bear in the initial expenditure and to operating expenses. He should then make a careful observation of the entire area to be affected by the proposed line, to ascertain the general route that can most advantageously be selected, keeping an eye to soils and substrata for their value as foundation, and upon drainage; and to local conditions, such as the choice

of one or another hillside, because of different exposure to winds, snowdrift, rock or landslides.

After the reconnaissance comes the survey, which determines the exact location of the road. There is usually an exploration made very quickly over the general route, without attempt at detail study; then a preliminary filling in of detail, of which complete notes are taken; and finally the location, which is indicated with the utmost detail of topography, for guidance in the letting of contracts and the construction itself. The importance of the reconnaissance and survey in general have been indicated by the statement that they determine what ought to be done, which is not less important than the doing The importance of this detail may be shown by just one instance, where on the final map the failure to show a rock ledge on a hillside resulted in unnecessary excavation which cost over eight thousand dollars in less than a mile of construction.

That the actual work of construction has been vastly facilitated by the methods of the last generation, hardly needs mention. The steam plow and the steam shovel are more effective on embankments and in excavation, than the multitudinous gangs of hand diggers loading into little carts: steam and electricity are both used in the boring

of tunnels: machines have even been devised for laying rails. The long and painful experimentation which the history of the Baltimore and Ohio Railroad typifies for the country, has resulted in definite knowledge as to the factors of construction, which vary as a line is to be built for heavy or light traffic, on the level or on steep grades. The policy adopted at times by certain companies to economize in every phase of construction by using light rails, poor ties, thin ballast, narrow roadbeds, poor masonry and light bridges is almost entirely of the past. Such a policy never saves more than two or three thousand dollars a mile, and its results affect injuriously the reputation of the road from the first day of its operation.

In the location of a line, an engineer rarely has choice of the ideal. Ordinarily neither curves nor grades can be avoided entirely. Although the statistics of accidents show that but a small proportion are directly due to or enhanced by curvature, it is quite true that a curve increases the danger of derailment, and of collision by obstructing the view of the engineer. It calls for a decrease in speed which hampers the making of time, especially in bad weather, and it interferes with that smooth running which contributes to the passengers' comfort. Severe curves are especially

burdensome in that they materially increase the expense of maintenance and operation, the excessive friction entailing extraordinary wear upon wheels, rails and crossties: they increase the consumption of fuel, and limit the length and weight of trains.

So also do grades increase the wear and tear on track and the consumption of fuel, hamper the making of time, and limit the trains on the line in general to a length and a weight that can be hauled up the maximum grade. The effect of the various factors however, of the relation of wheel and rail, of traction and adhesion, the adjustment of locomotives, cars and couplers have been so closely studied and elaborated, as to nullify the disadvantages of grades and curves that are moderate, and to reduce their evils in all cases. Where there is a curve on a grade, there is a growing tendency to diminish the rate of inclination around the curve, so that the resistance offered by a moving train is the same at all points on the grade, a practice known as "compensating for curvature."

Requisite to a good railroad track are a solid foundation, which often entails much cutting, filling and harrowing; provision for drainage, including ditches into which water may drain from the track, and culverts where necessary to carry drainage water or small streams under the track; adequate

ballast, which serves both for drainage and to distribute the weight and pressure of the trains, thereby preserving both the roadbed and the rails; and the most essential feature of the track, the rail itself. This, as we learn from the history of the Baltimore and Ohio Railroad, was first of oak and then of iron, fastened to longitudinal underpieces by clamps around the rails, over which engines and cars would bump and clank.

In the rail of to-day the revolutionary effects of steel are especially marked, the stiffness, strength and durability of that metal having reduced the annoyance of replacing, that was incessant with the iron rail. Its shape and chemical composition have been carefully studied. A committee of the American Society of Civil Engineers, after deliberating over three years, reported in 1893, upon a general type of section for a rail known as the American Society Standard. It is provided that the head of this rail shall contain forty-two per cent of the metal, the web twenty-one per cent, and the flange thirty-seven per cent. The weight of the rail has advanced in about the same ratio as the advance in the weight of locomotives. With 50-ton locomotives there were 50-pound rails; now 80-ton locomotives and 80-pound rails are in general

service, while 100-ton locomotives and 100-pound rails are not rare.

Where two rails meet is naturally a place of comparative weakness in the track, the pressure of trains tending to bend the rail ends and to depress the ties. This not only causes hurtful wear upon the track, but upon the equipment, the wheels as they pass over each juncture, receiving a shock, that is communicated to the machinery. The device of a splice bar, that would approach the ideal of making the track as stiff at the joint as at any other point of the rail, was approximately solved by the invention of the parallel bars. These so clasp and support the rail ends that a modern track, were it not for some allowance for the expansion and contraction of heat and cold at the rail ends, would be practically two continuous rails. These splice or angle bars, as they are usually called, are fastened to the rails by bolts of standard construction, which are prevented from loosening by a contrivance known as a nut lock. The rails are fastened to the ties by spikes which are also standard.

The kind of timber used for crossties depends largely upon whether or not timber has to be brought from a distance. Each of the many available woods may be peculiarly affected by

different kinds of climate. Attempts to make ties of metal, prompted by the growing scarcity of timber of all kinds in the thickly settled sections of the country have had some success, but in America metal is still much more costly than wood. The preservation of wood by chemical treatment is now considerably used to prolong the life of timber ties.

As ballast, different roads in different places use crushed stone, which is clean and affords good drainage, gravel which is nearly as good, furnace slag, cinders, sand and burnt clay, and in some regions where nothing better can be obtained, common earth or "dirt."

Incidental to the track is the mechanism whereby a locomotive or cars may leave a track for a siding or to cross over to another track. The name of this is a turnout in one case, and a cross-over in the other. Its essential parts are a switch which is constituted of two rails with moveable ends; and a frog, a grooved arrangement of the rails at the intersection, which allows a wheel to pass from one track to the other without obstruction. At the crossing of two tracks are required four frogs.

A switch is moved so that its ends will guide a train, to or from one track or the other, by a

lever operated through a switch stand which is surmounted by a target, a signal indicating by its position during the day, and by the color of a lantern at night, the position of the switch.

A wye is a track in the shape of the letter Y, the two short legs of which have a switch connection with a main track. A locomotive run out one leg and returned over the other, heads in the opposite direction when it regains the main track; that is, it has been turned around by running over the wye.

Where the traffic is composed of many different commodities consigned to different destinations, it is essential to expeditious, orderly, and therefore economical movement, that cars containing like commodities for the same destinations be placed together, either in separate trains or in parts of the same train. That cars may be shifted to accomplish this purpose, it is necessary that there be a number of tracks which constitute a "yard." This designation also applies to the fan-shaped arrangement of tracks leading into a large freight terminal, where they serve the similar purpose of allowing cars to be sorted either for loading or unloading at particular platforms.

The former type of yard is usually located in the vicinity of a large city, or at the intersection of

several tracks leading in different directions, either being a place to which local or shifting trains bring the diversified products of farms and factories in carloads and less than carloads, to be properly made up for through shipment. Such a classification or drilling yard is composed of a number of parallel tracks cross-connected at both ends, so that cars may be readily drilled between the main and any yard track, and between any yard track and another. The larger yards have one set known as the receiving tracks upon which the cars from incoming trains are assorted, and another set known as the classification or distributing tracks upon which they are made up in the desired order for outgoing trains.

The operation of switches where train movements are infrequent, is usually by the hand of one of the crew of the passing train, who readjusts the switch after the work is finished. Where train movements are more frequent there is a switchman who has no other duties than to make the proper adjustments and readjustments of the switches under his care. Where traffic is heavy and trains move repeatedly, and in large yards and terminals, the stand for operating switches are concentrated and enclosed in a switch and signal tower. Here they can be operated by one

tendant, sometimes by hand, but often through the agency of compressed air or electricity. Switches operated in this way are so interlocked with each other and with the signals indicating their position, that a signal cannot be set in any position except that which correctly indicates the position of the switch.

As the rail is the most important factor in the track, so is the locomotive the most important factor in the equipment. Its essential parts are the furnace, the boiler, the cylinders and the wheels. In the furnace is generated the heat that transforms the water in the boiler into steam, which passing through the cylinders drives back and forth the pistons that set the wheels in motion, thereby causing the tractive force that is communicated to the cars composing the train. The relative size, position and every detail of these parts, as well as of the mechanism of the communication between them; the apparatus whereby the status of the working is exhibited, and the control of the machine placed in the hands of the engineman, have elicited the most earnest attention of mechanical engineers from the beginning of the use of steam as motive power. From that first locomotive built in 1829 by Peter Cooper to the Mallet type mountain pusher,

which weighs 168 tons and has steam pressure of 235 pounds, recently placed in service on the Baltimore and Ohio Railroad, every step in the marvelous progress in efficiency has come only after searching discussion and exhaustive experiment. It is almost amusing now to reflect that the engineer who at first stood on top of the locomotive, where he could look at the track with, as was argued, an unimpeded vision, was not allowed protection from the cinders and the weather until a subsequent generation of designers insisted that he have the protection of a cab.

The various designations that are now applied to locomotives indicate different degrees of power and varying speed, which may be most readily distinguished by characteristic wheel arrangement; for example, the "American" engine has two pairs of driving wheels and a four-wheel truck in front; the "Mogul" engine has three pairs of driving wheels and a two-wheel truck in front; the "Consolidation" engine has four pairs of driving wheels and a two-wheel truck in front; the "Mastodon" is the same as the "Consolidation," but with a four-wheel truck. The "Atlantic" has two driving wheels on each side, a double truck in front and a single truck or trailer behind. The "Pacific" has three driving wheels on each side,

a double truck and a trailer. The "Mallet" locomotive has six driving wheels on either side, so arranged or "articulated" that they work in sets of three.

Some of the older railroads, especially the Pennsylvania, make in their own shops, after their own standards, many of the locomotives used on their lines, but it is usual for a railroad company to purchase locomotives of the large manufacturing establishments.

The locomotive is the instrument through which the tractive power is applied; the cars and coaches, the instruments through which it is made of use. The fact that the resistance to the pull of the locomotive increases only fractionally as rapidly as the increase in weight, has stimulated the development of freight cars from those of twelve and fifteen tons capacity to the firmly wrought structures of fifty tons capacity which are to-day common on the roads of great traffic. The ratio of weight of load in the old light cars to the weight of load and car combined was fifty-five per cent; in the new large cars it is often seventy per cent. The use of steel in car construction has facilitated the use of these larger structures. The open car has developed into the flat car, the gondola, the hopper bottom; the box car into the grain car, livestock

car, furniture car, refrigerator car. The passenger trains carry coaches, sleeping cars, baggage, mail and express cars and frequently dining cars, the tendency in all of which has been toward more solid construction.

Cars and engines were in early years connected by an iron chain linking one car to another, but to-day heavy couplers, interclasping in a vertical plane, firmly attach one car to another and to the locomotive; a passenger train being thus braced into what is almost like a solid projectile.

We have now enumerated the principal items in its structure that are characteristic of a railroad, the track on which the trains run, and the locomotive and cars which constitute the trains that run upon it. We can disregard here the correlated bridges, tunnels, stations, platforms, and other buildings and structures, for a brief consideration of that which is of the essence of operation, the running of trains.

The seemingly simple problem of stopping was troublesome in the days of George Stephenson and Peter Cooper. There were not many trains then, so that an engineer had an opportunity to let off steam and slow down a considerable distance before reaching the point at which he desired to stop. A brake was the product of slow and painful

invention. That which endured for many years was a hand brake, an instrument which when turned by hand coiled around its shaft a chain, which brought a brake to bear upon the car wheels. Now tubes, filled with compressed air by a pump on the locomotive, extend under the entire train, and are connected under each car with a reservoir cylinder, into which compressed air flows through the tubes. The pulling of a cord from any car or from the locomotive, or the sudden parting of the train, throws a valve through which this compressed air rushes into an adjoining cylinder containing a piston and rod which, by the inrush, is forced back, setting the brake to the wheels. The degree of compression in the tubes and reservoir cylinder is so great that when the air rushes into the brake cylinder, its force but little diminished, is still amply efficient to set the brakes.

The man responsible for the starting or stopping of a train must have some means of communication with the man in charge of the locomotive. This necessity led after many years to the placing on passenger trains of a cord running through each coach to a bell in the locomotive. This during recent years has largely been superseded by a signal in the locomotive, sounded by means of compressed air in tubes extending throughout the train.

These air whistle, or bell cord signals are as follows :

WHEN TRAIN IS STANDING

Two sounds—Start.
Three sounds—Back.
Four sounds—Apply or release air brakes.
Five sounds—Call in flagman.

WHEN TRAIN IS RUNNING

Two sounds—Stop at once.
Three sounds—Stop at next station.
Four sounds—Reduce speed.
Five sounds—Increase speed.

The necessity for communication, between a man directing its movements and the man in charge of the locomotive, has also developed the system of signals made by placing the hands by day, or the hands with a lighted lantern at night, in certain positions as follows:

HAND, FLAG AND LAMP SIGNALS

MANNER OF USING	INDICATION
Swung across the track	Stop.
Raised and lowered vertically .	Proceed.
Swung vertically in a circle across the track—	
When the train is standing . .	Back.
When the train is running . .	Train has parted.
Swung horizontally in a circle—	
When the train is standing . .	Apply air brakes.
Held at arm's length above head—	
When the train is standing .	Release air brakes.

Any object waved violently by any one on or near the track is a signal to stop.

By means of the whistling of his locomotive in combinations of long and short blasts, the engineman signals and responds to signals by the following established code:

O, A SHORT BLAST. —, A LONG BLAST.

O	Stop, apply brakes.
— —	Release brakes.
— — OOO or — OOO	Flagman go back and protect rear of train.
— — — —	Flagman return from West or South.
— — — — — —	Flagman return from East or North.
— — —	When running, train has parted.
OO	Answer to any signal not otherwise provided for.
OOO	When train is standing, back.
OOOO	Call for signals.
— OO	Calling attention to signals displayed for a following section.
— — OO	Approaching public crossings at grade.
———	Approaching stations, junctions or railroad crossings at grade.

A succession of short blasts is an alarm for persons on the track, and calls the attention of trainmen to danger ahead.

If there were never on a railroad track more than one train at a time in each direction, the engineman of either could pursue a safe course by keeping a lookout for the other train, and slowing down or lying by on a sidetrack at the time of passing. This procedure sufficed in the early days when there were several trains, it being the duty of each engineman to know every other train on the track, and keep a constant lookout. With a considerable increase in the number of trains, and in irregularity of movement that might arise from a variety of causes, it is obvious that there is necessary a central source of information wherefrom there can be communication with the engineman of each train, as to the other trains upon the same track, their whereabouts, and the relation that his train must bear to them. This was provided by the electric telegraph by which from a central office a message can, through a local station, be sent to a train along the road, instructing those in charge of it what action to take in regard to another train, or other detail of its movements.

The system whereunder trains move according to prescribed arrangement, supplemented by direction through the telegraph, is in outline as follows: There is a carefully prepared time table which shows the time fixed for each train to leave

and arrive at each terminal station, the time at which it is due to stop at any intermediate station, and the time and place at which it shall pass each other train. If trains always ran according to the schedules in such a timetable, if there were never any more trains than provided for by it, and if no one of them were ever prevented from making the time specified, there would of course be no necessity for the telegraph. But on a modern railroad where trains are often run in two or more sections, where there are at times extra trains and special trains, and where for one reason and another trains are not infrequently detained, the schedules would often become so deranged that the movement of trains would be completely blocked. Therefore has arisen the very important function performed by the Train Dispatcher and his assistants.

The dispatcher sits at a central office at a table on which is a sheet containing a record of every train, the names of its crew, the number of the locomotive and the number of cars, and the time of leaving the terminal station. As this train passes each telegraph station the operator thereat wires that fact with the time of passing to the train dispatcher who makes entry in the record. The train dispatcher is thus advised of every train and its whereabouts.

In case there is a derangement of the regular schedule, or in case of special trains or other contingencies, he telegraphs to each train that it is necessary especially to direct, an order specifying the time it shall observe, and the meeting and passing points with other trains. These instructions are telegraphed to an operator at a station which the train is approaching: to ensure accuracy they are repeated by that operator to the dispatcher. They are then delivered on the arrival of the train to the conductor and the engineman, each of whom acknowledges receipt of the order, and this fact is also telegraphed the train dispatcher who makes entry in the record.

The protection of the schedule and the guidance of the dispatcher cannot, however, guard the engineman through all the minor incidents and contingencies that concern the safety of the track; such as giving assurance that a switch is in position, that a station is free for approach, that a siding is clear, or giving warning in case of danger. To meet these requirements there is the code of signals of which the whistle (audible) signals, and of hand and lamp (visible) signals already described are a part.

Other general visible signals are as follows: **Red,** indicating "stop;" White, indicating "Pro-

ceed;" Green, indicating, "Proceed with Caution." These colors are used in connection with switches, and generally—with slight variations and modifications—in whatever connection to denote whether a track is clear, occupied or closed.

Other general audible signals are provided by the placing of torpedoes upon the track: the explosion of one torpedo is a signal to stop; of two at a close interval, a signal to reduce speed and look out for a stop signal.

A further expediting and safe-guarding of the movement of trains, was attained by the development of the system whereby, when a train has passed a certain point, a signal at that point is so adjusted as to forbid another train passing it until the first train has passed a further point, thus maintaining between the two trains a space interval. This is the block signal system, the mechanism of which has been so improved by the application of electricity that the adjustment of both the near and further signals is made automatically by the train itself. These signals are arms or semaphores, extending from an upright post, and indicating by their position by day and color of lantern at night, whether or not a block is clear. A signal at a point where it is immediately effective upon an approaching train is a "home" signal: a preliminary

signal indicating the position of the home is a "distant" signal.

That the conduct of the various phases of construction and operation of a railroad necessitates an elaborate organization is self evident. Although the organizations through which the work of the principal systems is performed differ to an extent, their essential structure is the same.

The construction described in the opening paragraph of this lecture was of a new railroad, or an addition to, or an extension of an existing line. Such work is always under the charge of an officer entitled the Chief Engineer: he is assisted by subordinate engineers and the transit men and rodmen that constitute a surveying corps.

The subsequent paragraphs contain but a meagre outline of the elements of the physical maintenance and operation of a railroad. They show however, a naturally threefold classification. First, that which pertains to the road or the way; that is, the right of way, track, trestles, bridges, tunnels. Second, that which pertains to the equipment; the locomotives, cars and coaches. Third, that which pertains to the movement of the equipment; that is, the running of trains. This natural classification determines the three departments known as:—First, the maintenance

of way; Second, the maintenance of equipment, or, as it is commonly called, the motive power; Third, conducting transportation. In these, and especially in the two former, is necessary expert training in and practical knowledge of civil and mechanical engineering, electricity, the principles of building and of the allied sciences, especially as applied to this field of activity. From this in barely three quarters of a century has sprung a literature that makes the vocation of a railroad officer a profession. From the setting up of the first transit and the removal of the first spadeful of earth, to the design of a locomotive rivet, and the determination of the proper color and position of a semaphore arm, there is an amplification of detail which must be mastered by the apprentice, and which is undergoing continual revision and re-adaptation to changing conditions. To the discussion and experiment upon which this revision is based, railroad officers of the country give their time and their knowledge in the same disregard of pecuniary reward that distinguishes the physician and the surgeon, who give to the world the benefit of any step which they make in the progress of their science. Thus the present system of signals and train orders was adjusted for the United States, after

years of intent deliberation, by the committee of the American Railway Association and the Association itself: the practice of the railroads was scrutinized, and that which was best was selected and formulated into a code which is now standard for the country.

In these three divisions of railroad activity are engaged the energies of one million, two hundred and fifty thousand employes, over ninety-six per cent of the total one million three hundred thousand. It goes without saying that to the effective utilization of these forces must be not only well planned organization, but careful direction and efficient control.

The plan and the performance of any organization composed of men is of course determined by the capacity and characteristics of individual men. By far the greater number of these featherless bipeds on this earth, have not attained a mental development beyond that necessary to guide their hands and feet in such performance as may be prompted by their instincts, or may have been drilled into them until it has practically become instinctive. Of such is the type which makes the common laborer, whom a railroad company needs in large numbers in constructing and maintaining embankments and excavations, in placing

ties and ballast and laying rails. That his work may be persistent and well directed the laborer must be under constant oversight, a function which calls for that grade of mental capacity which can perceive what constitutes a simple task, how it should be done, and that another does it. This distinguishes the foreman, who is given supervision over as many men as he can efficiently direct; that is, over a gang the number of which may vary, according to the task and the directing capacity, from half a dozen to half a hundred. It is often necessary that the work of the foremen of various gangs working toward the same end be directed and the work inspected; that is, that there be a supervisor. Such close, constant personal attention as the word supervision implies, limits the field of a supervisor to a length of road, of which no portion need be out of his sight more than one or two days at a time.

In the effective application of labor, calculation is necessary as to the adjustment of labor to material, and material to labor, the provision of material of proper design, quality and quantity. Training is needed for this, and therefore an engineer whose territory is co-extensive with that of like officers of other departments. This is usually 'designated as a division, the limits

of which as a rule are no more than can be traversed by a train in a day. On a modern railroad there are many such divisions. In order that the work of the division engineers may be co-ordinated and provision be made for the entire system, there is an Engineer Maintenance of Way in charge of and responsible for the performance of his department.

The elements that underlie the organization responsible for the maintenance of way, apply in large measure to the organization responsible for maintaining the equipment. In the repair and construction shops are the common laborers who do the rough work; mechanics and carpenters who tend machines and perform the tasks of greater complexity; the foremen who see that work is done; the Master Mechanic who supervises; the Superintendent of Motive Power who applies to the oversight of locomotives, cars and coaches the principles of mechanical engineering. Finally, there is the General Superintendent of Motive Power who analyzes different types of equipment and their performance, studies materials, keeps abreast of inventions, and adjusts the motive power and rolling stock of his company to needs of the traffic.

When motive power is in operation, it is in charge of engineers and firemen, who are responsible

for a locomotive as a machine to the motive power department. In this phase of their duties they are under the direction of a road foreman of engines. For the performance of the locomotives in the movement of a train, and their duties in that connection, they are employes of the transportation department.

In the work of transportation proper, that which immediately concerns the running of trains, there are no common laborers. The mental capacity necessary to an intelligent understanding and application of the signal code, the physique that can withstand the stress of hours of activity, every day on a moving train, in all sorts of weather; and the morale that will not flinch from the responsibility involved in the care of life and property demand education, character and health in brakemen, conductors, firemen and engineers of both freight and passenger trains, as well as in baggagemen and expressmen. For service at the stations, for the station agents, cashiers, ticket sellers, the requirements average as high and there is necessarily a high standard also for the operators in the telegraph offices and the signal towers.

The assignment of the men that man the trains, and their discipline in immediate performance is in charge of a trainmaster. The direction

of the running of trains, as has been previously stated, is in charge of a train dispatcher.

The telegraph, like the motive power department, presents a twofold aspect. The maintenance of the poles and lines is one feature: and the operating, that is the sending and receipt of messages, the other. The maintenance is usually in charge of gangs and foremen corresponding to those in the maintenance of way department: they are under the supervision of an inspector, and the head of the organization is usually entitled the Superintendent of Telegraph. The dispatcher and station and signal operators are usually under the charge of a division operator.

In considerating the maintenance of way department, it was perceived that the needs of the work determine the extent of track upon which the most efficient performance can be obtained from a supervisor and an engineer. The consideration that a machine cannot be economically run without intervals for rest and thorough overhauling, and that engineers, firemen and conductors cannot give efficient attention to their duties more than a certain number of hours out of the twenty-four, also indicates that there must be a limit to the length of line over which either men or machines can work continuously. This

length of line is designated as a division; it is frequently determined in part by the relative location of traffic centres, or points for traffic distribution, between which the time required by a running train may more or less nearly coincide with the hours during which men and machines may render uninterrupted efficient service. The fact that the division marks the length of the run means that on a division there must be some place for overhauling of locomotives and preparing them for a fresh start: this is the roundhouse, the reason for the name and the shape of which are obvious. On a division there is also usually a repair shop of greater or lesser proportions.

That the different phases of operation may be co-ordinated the division of the engineer, of the master mechanic, of the division operator, of the trainmaster and of the train dispatcher is nearly always identical, and is therefore the unit of the physical operation of a railroad. For this unit of operation there must necessarily be a responsible head who is entitled the Division Superintendent.

Whether the division heads of the maintenance of way, motive power and other sub-departments shall report to the division superintendent, who shall be charged with the necessary communication in connection with his division and pertaining

to these departments with the general heads thereof; or whether the different heads of these departments for each division shall communicate directly with, and be directly responsible to the Engineer Maintenance of Way, General Superintendent of Motive Power, and so forth, is a question in regard to which there is difference of opinion and difference in practice. That all of the phases of divisional activity may be kept in harmonious co-relation, that there may be that centralized power which is essential to centralized responsibility, it is argued that each division officer should report to the division superintendent. On the other hand it is contended that this practice burdens the division superintendent with details of matters with which he is not entirely conversant, for which he is not ultimately responsible, and therefore distracts his attention from his most important function, which is the direction and discipline necessary to the proper running of trains. The former is styled the divisional system of organization; the latter the departmental system of organization. The divisional system is effective on the Pennsylvania Railroad, where the division superintendents are men of all-round training thoroughly grounded in the principles of each of the phases of construction, maintenance and operation.

The departmental system is that usually in effect on railroads in regions of thinner traffic, where there is no such volume and complexity of detail that divisional efficiency will be endangered if the divisional authority is not concentrated. The Baltimore and Ohio, in common with the Lake Shore and a few other railroads, pursues a middle course between the divisional and the departmental systems.

On a railroad system of many divisions engaged in many kinds of traffic, there are periods when the need for certain kinds of cars may be greater on one portion of the system than on another; the demand for certain cars that is intense at one place to-day, may be most pressing at another place to-morrow. Among the many shippers, and especially those competing for the shipment of the same commodities in a restricted region, there must be an equitable distribution of empty cars. There must be continual watchfulness to prevent cars being retained on side tracks, and delayed in yards; and to prevent cars being retained on other roads to which they may have been consigned. As the revenue of a railroad is derived from loaded cars in motion, it is to its advantage to keep at all times the greatest possible proportion of its cars loaded and in transit, a duty which, it will be

perceived, includes all of the elements enumerated in this paragraph. To this end there is on every large system an officer entitled the General Superintendent of Transportation, charged with these functions, and usually with the correlative oversight of the fast freight trains, the seeing that freight, such as perishable commodities and consignments destined for export on particular steamers, receive the especial despatch that the conditions necessitate.

It goes without saying that if each division or other officer endeavored to purchase the material and supplies needed in the work under his direction, his time would be largely consumed in obtaining prices and giving orders. The result would be that manifold purchases, often of the same commodity from many sources, would cause confusion, and loss from not securing the lower prices accorded for the large quantities, attained by the concentration of orders. Hence every railroad company has a purchasing agent, to whom are made requisitions for material by the different departments, whose duty it is to watch the markets and buy in such quantities and at such times as provide the most favorable conditions. It is also customary for a railroad to have a testing department, allied usually to the motive power department

ment, whose duty it is to apply physical and chemical tests when necessary, to all material obtained by the purchasing department, that assurance of requisite quality may be obtained.

In this lecture, no reference has been made to phases of activity or features of organization, except those that pertain directly to the physical construction, the physical maintenance or the physical operation of a railroad. The enumeration of these, which has necessarily been only typical and approximately complete, is a specification of different sub-departments, which together form what is generally known as the operating department. The responsibility for this department is centered upon an officer entitled the General Manager, to whom the Engineer Maintenance of Way, the General Superintendent of Motive Power, the Superintendent of Telegraph, the General Superintendent of Transportation, the Purchasing Agent report and are responsible, as are also the Real Estate Agent, the Superintendent of Floating Equipment and other co-related officers whose duties are indicated by their titles. On some railroad systems where the departmental organization is pronounced, the General Manager is responsible for the conducting of transportation only, and in common with the heads of the maintenance of way, and motive power

departments, and the Chief Engineer reports to a Vice-President, who is specifically responsible for construction, maintenance and operation.

In this operating department, as has been said, are employed one million, two hundred and fifty thousand persons, over ninety-six per cent of the railway employes of the United States. To them is paid in wages which go to the support of themselves and their families, and to dealers in the supplies used by the railways, nearly one and one-half billion dollars, which is nearly seventy per cent of the gross earnings: that is, for every dollar received by the railways of the United States, nearly seventy cents are paid directly or indirectly to the wage worker.

The majority of the employes, and especially those of the transportation department, come to the railroad service in their youth, from homes in the smaller towns and in the country. They are taught to be punctual, for there can be no procrastination on the part of any one concerned in the running of a train; to be observant, for not to see a signal means disaster; to be attentive for neglect or forgetfulness—that might be the venial oversight of a moment in the daily routine of most of us—to the train dispatcher or the engineman, may mean the loss of life and property; to be

temperate, for in the running of a train are needed the sound mind in the sound body. Under the steady pressure of the conditions that surround their lives, the railroad men of the United States are becoming a soldierly class, examples of sobriety and reliability to their fellows.

It is too true, however, that it is not within the province of finite man to fashion timber or metal so that it will never break under strain, even at the most unexpected times and places; or to make other men immune from the errors to which flesh and blood and brain are given. To reduce the faults of structure to a minimum, and the errors of his subordinates to the vanishing point is the constant effort of the operating officer.

The difficulty of this endeavor has been much enhanced by the change in commercial conditions during the past decade. Ten years ago the stagnation of industry and consequent small volume of traffic, made it impracticable for a railroad manager to retain more than the nucleus of a disciplined force on his pay rolls. Then all of a sudden mine and mill, farm and factory, brought forth traffic in unheard of volume that has increased every year. This suddenly awakened activity not only found the railroads inadequately manned to meet it; but the industrial concerns, by the payment of wages

which the railroads could not possibly afford, took many of their best employes. This and the necessity of immediately recruiting their ranks as best they could, led in many cases to the advancement of men to responsible positions, whose progress under normal conditions would have been through more extended and thorough apprenticeship. It has also been necessary for the railroads to largely rebuild their plant and renew their equipment during this period, that has called for the use of every locomotive and every car that could be pressed into service, leading to the forced and unfortunate use of old and new equipment in the same trains. Speaking broadly and generally, the magnitude and stress of the demand that has been made upon the railroads during the past half dozen years has been a large factor in causing the accidents that come to the knowledge of all men, because they are carefully reported, tabulated and published far and wide. Distressing however as the casualties due to these accidents have been, it is only the simple truth that they are not only far less in number than those in other industries, but less than those that befall in the daily routine of life. These accidents of daily and routine occurrence that are scattered throughout the communities of the country are not reported, tabulated

and published, but their statistics are known approximately to the accident insurance companies, on the strength of whose records this statement is made.

III

TRAFFIC

In its function of transportation, a railroad carries both persons and things. The carriage of persons, that is of other than those employed in its service, constitutes the passenger traffic. The carriage of things is of the communications, periodicals and small packages which constitutes the mail traffic; of commodities on passenger trains or passenger train schedule, which constitutes the express traffic; and of commodities in general, which constitutes the freight traffic.

The carriage of express is under special contracts, that are entered into either annually or for a term of years; the carriage of mail is under conditions determined by the United States Government.

The carriage of persons, which constitutes the passenger traffic, and of commodities, which constitutes the freight traffic, is usually under contracts that are made separately for each act of conveyance. Between a railroad company and a passenger is therefore necessary some evidence of

contract, which shall show between what stations the passenger has purchased and the railroad sold the right to travel, and the conditions under which this sale has been made. This evidence of contract is a ticket. Between a railroad company and a shipper is necessary some evidence of contract, which shall indicate the commodity to be shipped, the quantity, from and to what place, and the conditions under which the shipment is undertaken. This is a bill of lading. A ticket or bill of lading calling for transportation between two stations on one and the same railway, is a local ticket or bill of lading; if it call for transportation between a station on one and a station on another railroad, it is a through ticket or bill of lading.

Passengers are received and discharged, commodities are loaded and unloaded, at certain stopping places of trains or cars, which are designated as stations, and are in charge—with negligible exceptions—of a station agent. It is the station agents who sell tickets, and issue bills of lading, and through whom therefore is conducted the greater portion of the intercourse between a railroad company and its patrons. The performance of these duties, the care of the station property, the maintenance of acquaintance with the persons

and conditions of his locality, require specialized and concentrated attention, which in the larger communities is divided between a ticket agent and a freight agent, each of whom may have a corps of assistants and clerks.

The officer in the traffic department next above the station agent, is the division or district passenger agent, and the division or district freight agent, each of whom keeps informed of the traffic conditions at each station in his territory. The division freight agent knows the producers and merchants of each town in his district, the kind and quantity of merchandise shipped and received by them: he watches the fluctuations in shipments to see whether a decrease in their amount is caused by decreased demand, ill-adjusted rates, inadequate facilities for reaching markets, or whether increased consignments are being forwarded over competing lines. The district passenger agent endeavors to stimulate travel by advertising the advantages of the road, and the country and resorts reached by it; by organizing excursions, and watching and facilitating the movement of organized bodies such as lodges, delegates to conventions, and theatrical companies. These officers issue instructions to and obtain information from the station agents in regard to these phases of their

duties; and they are the first recourse of a passenger or a shipper who desires to obtain information, or to conduct negotiations beyond the scope of the station agent. They continually transmit advice to their superior officer in regard to the traffic conditions in their respective districts, the need for rate adjustments to meet frequently arising contingencies or permanent changes in the traffic currents, and in regard to the distribution of freight cars to supply the requirements of shippers, or of passenger coaches to fill the demands that are not met by regular trains. They are also in constant receipt of instructions from their superior officer, who is charged with still less of the detail that pertains to current transactions, and maintains a still wider survey of the traffic field. This is the General Passenger Agent, or the General Freight Agent, as the case may be, above whom there is a traffic manager, or a vice-president in charge of traffic, under whose authority rates of freight and rates of fare are issued. This officer is informed of the total expenditure and the total revenue of the company, of the total volume of traffic, its constituent parts, the fluctuation and peculiar needs thereof. He consults with the ranking officer of the operating department in regard to the number and time of

trains, conducts communication and negotiations with the traffic managers of other railroads as to the adjustment of through rates, the apportionment of through revenue between the respective lines, and all other questions that pertain to the exchange of traffic. An efficient traffic manager practically knows the conditions of every business and of all markets, and his unceasing effort is to increase the movement of traffic to and from these markets.

With the endeavor to secure the movement of the greatest quantity of commodities is associated an effort to increase the population, and develop the resources of the country tributary to a railroad company's lines. The greater the population the greater is the capacity both for production and consumption, and therefore the greater the demand for the services of the railroad. To this end many railroad companies, especially those traversing sparsely settled regions, maintain usually as a bureau of the Traffic Department, a Land or Industrial or Immigration Department, as it is variously designated, under the direction of a man who is familiar with the qualifications for industrial and commercial purposes of every region penetrated by the railroad. He presents the advantages of localities to those desiring to establish

or more suitably place business enterprises, helping them to study the soil, timber, mineral and other resources, and the relation to various markets to which he aids in obtaining reasonable rates. He calls the attention of homeseekers to undeveloped territory, and endeavors to direct the travel of immigrants to where they can obtain employment. In the report of the Southern Railway it was shown that over seven hundred industrial enterprises had been located along its lines during the year ending June 30, 1905, through the efforts of its land and industrial department.

It will be perceived that the organization of the traffic, as of the operating departments, is composed in the first grade, of men whose time and energy are consumed in attention to matters that come within the range of their immediate personal contact; in the second grade, of men whose information and grasp is of a wider scope; and third, of the administrative officers to whose broad grasp is brought the fullest information, which they co-ordinate into a policy that is communicated throughout the department.

To aid in securing the information upon which this policy is based and in carrying it out; to solicit traffic; to maintain an extended and intimate acquaintance with the characteristics and

needs of the patrons of the railroad, whose operations may not in all cases be situated immediately upon its lines, and to render assistance to the station agents when necessary, there is usually subordinate to each district passenger agent and district freight agent, a corps of traveling passenger, or freight, or contracting, or commercial agents as they are variously designated.

Before giving further consideration to the organization and functions of the traffic department, let us consider the principles that underlie its principal function, the making or rather the adjustment of rates.

Railroad transportation at the time of its introduction, as a matter of course, was obliged to conform to the laws which govern the coming of any services or commodity into the market; that is, the early railroads were obliged to furnish transportation for a lesser price than existing agencies, or to a greater degree of satisfaction, or both.

That a lower rate for transportation was a controlling incentive to the adoption of the railroads as carriers, is manifest from that portion of the charter granted by the State of South Carolina to the historic road which was built from Camden. The principal means of land transportation theretofore had been by wagon along the turnpike, and

it was the general custom that the rate of transportation by wagon was twenty cents per cubic foot for light weight, and one dollar per one hundred pounds for heavy articles, per one hundred miles. The minimum charge was for twenty miles, because twenty miles was a day's work, and a lesser haul spoiled the day. A wagon had a capacity of two hundred cubic feet, and four horses could haul four thousand pounds or two tons. The minimum charge for one hundred miles for the wagon load was therefore fixed at forty dollars.

The South Carolina charter permitting the construction of the Camden Road, decreed that its charge should not exceed ten cents per cubic foot for light weight articles, and fifty cents per one hundred pounds for heavy articles, per one hundred miles, thereby arbitrarily making the railroad tolls one half the wagon tolls. The railroad accepted the dictum to mean that the usual railroad charge should be one half the wagon charge; it divided its territory into ten-mile districts, one half of the mileage for which wagons made a minimum charge, and adjusted its rates at one hundred pounds per ten miles. Somewhat similar provisions were contained in charters granted by North Carolina, Georgia and Florida.

It will be perceived that these early railroad tariffs in the United States were adjusted without any reference whatever to the cost of transportation: the rate was fixed before the means of transportation had come into existence.

Very soon it was perceived that the distinction between light weight and heavy articles made in wagon transport, would have to be modified by the difference in the value of the commodities. Otherwise the railroad might be hauling a carload of material light in weight but great in value, for much less revenue than it would derive from a carload of material heavy in weight but low in value. This would have little or no effect upon the volume of the more valuable material transported, but would operate to materially decrease the volume of the less valuable.

These considerations, growing out of the different characteristics of commodities in relation to handling and revenue, led to a classification whereunder a rate was fixed for a class instead of a commodity; and each commodity in a class paid the rate fixed for that class. The classification, ill-defined at first, has developed into definiteness along the following lines: the rates made necessary by competition; the volume of business; the direction in which freight moves,

including the circumstance whether cars return loaded or empty; the value of the article; the bulk and weight; the degree of risk; the special conditions, such as special equipment and special care enroute.

At first the classification varied sometimes between one railroad and another. Competition, the growth of through traffic, the similarity of conditions throughout a given area have, however, through deliberation, discussion and strife, reduced the number of classifications to three, which are uniform throughout respective regions as follows:- The Official Classification, in the territory east of the Mississippi and north of the Ohio Rivers; the Southern Classification, in the territory east of the Mississippi and south of the Ohio Rivers; the Western Classification, in the territory west of the Mississippi River. The differences in these classifications are often a source of complication when commodities are billed through from one region to another, but the different characteristics of the different territories, the different quantities in which different commodities move in the respective regions, make it exceedingly difficult to reduce the number of classifications. There is moreover a Transcontinental Classification applying to some classes of through freight from and to the Pacific

Coast, and certain of the State Railroad Commissions have added to the perplexity by establishing separate classifications for traffic within their respective states. Each classification contains about eight thousand commodities which are grouped in from six to ten classes, but the commodities that move in the greatest volume, such as coal, or under especial and peculiar conditions, such as fresh fruit and vegetables, are carried under especial or commodity tariffs which fix a specific rate for a specific commodity.

The prime fact to be considered by a railroad company in adjusting its rates is that the total revenue must exceed the total expenditure. If it do not there is a deficit: the railroad sooner or later becomes bankrupt, must be sold out and undergo reorganization. A railroad in the United States cannot, like the Post Office Department, or like the railroads in countries where they are owned by the Government, make up a deficit from taxation. So far as its balance sheet is concerned a railroad company in the United States is a business enterprise, subject to bankruptcy as is any other business enterprise. It is judged always by the test of pecuniary success.

It must also be borne in mind that a railroad is one mechanism, every part of which is corre-

lated with every other part both in construction and operation. When it is said that a railroad has cost so much per mile, there is meant only an average cost, that has no relation to the cost of any particular mile. The cost of terminals is vastly greater than of intermediate property; of bridges and tunnels than stretches over prairie; and a yard five miles long may easily cost more than one hundred miles of straight track. In sparsely settled country of thin traffic, or on branch lines, there is not needed as much rolling stock per mile as in populous districts, or on main line.

The current expenditures as grouped by Mr. W. M. Acworth, the eminent English railway economist, come under three heads: (1) maintaining the organization, (2) maintaining the plant, (3) doing the work. The expenditure for maintaining the organization embraces the charges for administration, which bear only a remote relation to the mileage of the road, or the amount of business done. Of the expense for maintaining the plant, it is estimated that about three-fifths is independent of the amount of business done. Rails wear out, but they also rust out; the wind and the rain wash away the ballast, beat down the embankment and wear away the structures. Of the expenditure for doing the work, a very considerable proportion

has to be incurred whether there be a large or a small volume of business. The number of stations and track employes does not increase and diminish in proportion to the volume of business: locomotives and cars become disabled not only through wear but through disuse, and every few years they are supplanted by new standards. Whether a car or a locomotive run a few miles more or less during the day, or a few thousand more or less during the year, has little effect in hastening the consignment to the scrap heap. The cost of the fuel supply is in close approximation to the mileage of the locomotives, and so also are the wages of the train crews, but even these items do not vary to a considerable degree as the trains are light and heavy, as they contain more or fewer cars, whether the cars are loaded or empty.

That is, the expenditure of a railroad must be regarded as a whole. This total expenditure cannot be allocated among particular trains or particular cars, and therefore it cannot be determined just what it costs to haul any particular commodity any particular distance. This fundamental concept, which no student of railway economics refutes, was announced by Judge Cooley, its first chairman, in one of the early reports of the Interstate Commerce Commission.

If the expenditures of a railroad for doing the work do not expand and contract in proportion to the volume of traffic, it follows that more cars can be hauled by a locomotive almost as cheaply as fewer cars; the expense for hauling loaded cars is but little more than for hauling empty cars; a greater number of trains can be run upon a track almost as readily as fewer. Therefore, to obtain the greatest return for its expenditure, a railroad company must run the greatest possible number of trains, each composed of the greatest number of cars, and each car to the extent that may be possible must be loaded to its capacity: the revenue from no portion of the traffic must fall below the immediate outlay for obtaining and handling that particular traffic; that is, for the expense of soliciting, and the immediate expenses to which it gives rise, which can be approximately ascertained. The revenue of a railroad company must also be considered as a whole, and any portion of that whole is a gain so long as it exceeds the immediate expenditure which it entails. In other words any revenue that more than pays for the immediate expense contributes toward defraying the remaining expenditure, which to a greater or less extent is independent of the amount of business done.

If a railroad were to charge the same rate of freight for the same weight of each commodity, it would charge no more for dry goods than for coal; and therefore enough dry goods to stock a department store, requiring because of their light weight and great bulk, a half dozen trains to transport them, would pay no more than one train load of coal.

If a railroad company charge the same rate of freight for the space occupied in each car, that is, by the cubical contents of each commodity, it would charge more for charcoal or coke, which fills a car from side to side and top to bottom, than for live stock which does not nearly occupy the cubical capacity of a car, and in addition needs particular attention.

If it be said that a railroad company should charge according to the cost of service, we are at once confronted with the fact already ascertained, that a large portion of the expenditure of a railroad is entirely independent, and an additional proportion is to a degree independent, of the service performed. Moreover, the quantity of traffic that will move at any given rate can at no time be predicted, whereas the rate has to be determined in advance. The outlay even for running expenses may differ vastly at different times.

There remains that basis for the freight charge designated by the widely misunderstood and greatly abused term, "what the traffic will bear."

It is obvious that the freight charge on any commodity cannot, in the long run, be greater than the difference between the cost of production at the place of origin plus the merchants' profits, and the price which can be obtained for that commodity at the place of destination. The commodities carried by a railroad, with inconsequential exceptions, are destined for a market. That it may run the greatest possible number of trains, each composed of the greatest possible number of loaded cars, a railroad company must seek the greatest traffic. Therefore it must so adjust its rates that the greatest volume of traffic may find a market. If a railroad were to charge no more for hauling dry goods than for coal, its revenue as a whole would not be sufficient to pay expenses: if it were to attempt to charge as much for hauling coal as for dry goods, there wouldn't be any coal hauled.

The application of this principle means that traffic, that will not find a market, unless it is hauled five hundred miles for the same rate as for fifty miles, must be hauled five hundred miles

at that rate: otherwise it would not be hauled at all, the producers would be deprived of their livelihood, and the consumers of that which contributes to supply their wants. This principle was given striking exemplification when Mr. J. J. Hill reduced the rates on lumber to a point that enabled the products of the forests of Oregon and Washington to be sold in the East. Thus these markets were supplied with lumber which they needed, and that otherwise would have been restricted to a narrow market; while the railroad company obtained traffic for cars that otherwise would have returned to the East empty.

If to obtain traffic that would otherwise go over another route, a railroad must make lower rates than to intermediate points on its own line, it must make these rates: otherwise the traffic to the intermediate points would have to provide for all of the expenditure, but if a portion of the competitive traffic is obtained, the burden upon the intermediate traffic is so much the less. If it is a link in a through line that competes for traffic with another through route, a railroad must for the same reason accept such proportion as it can obtain of the through rate necessary to secure such traffic. Thus in one of its early decisions, the Interstate Commerce Commission upheld this

principle by declaring that the Grand Trunk Railway was justified in charging a lesser rate on certain competitive traffic from Boston to Chicago than to St. Albans, Vt., it having been shown that the rate to St. Albans was not unreasonable, and that the traffic to Chicago could not have been obtained at a higher rate. It is unquestionable that in the competition between direct and round-about lines an undue volume of traffic, by cut rates or other devices, has at times been secured to the latter. To the extent that this diversion of traffic to the long lines is an abuse, it could be remedied by agreements between the competing lines, were such agreements allowed.

If it be necessary for a railroad to secure traffic in competition with a steamboat line, to make lesser rates than it obtains for similar traffic on other portions of its lines, it must make these lesser rates: otherwise the railroad would not haul the traffic at all, and the traffic not in competition with the waterways would have to bear the entire burden of the railroad's expenditure. Thus the railroads extending along the Atlantic seaboard charge far less rates per mile from New York, Philadelphia and other Atlantic seaports to the southern markets than are charged from Chicago, St. Louis and other interior commercial

centres to the same markets. The latter rates are no higher than are charged for similar service in the same region, whereas if the former rates were raised the traffic would all go by the coastwise steamers.

That a region served by a railroad company may attain and continue in prosperity, the commodities which that region is fitted to produce, must be marketed in the greatest quantities; and therefore the railroad must make rates that will allow them to penetrate, in competition with similar commodities of other regions, even to remote markets. Thus rates have been made on cotton goods from the Southern mills that allow them to be sold in competition with the products of the mills of New England; and the asphalt of California is carried to the central and eastern states, in competition with the asphalt of Texas and the West Indies. If the coal mines, saw mills, textile factories or other industries, upon which the livelihood of a community depends, are driven out of business the community decreases in prosperity, and finally in population, and the traffic of the railroad suffers not only by the loss of that which it carries out, but of that which it brings in. This extension of the markets of the various products of the farms, the mines and the mills has con-

tinued until at this time it is hardly exaggeration to say that, except for the very heaviest and coarsest articles, the products of each region are in competition with the similar products of all other regions, in the markets throughout the United States. The producers of each region are therefore not only given the widest markets for their products; but each market, that otherwise would be restricted to the products of nearby localities, is given the choice of supply from various producing regions, inducing competition that holds down prices, and tends to give them uniformity and stability.

It is obvious that commodities that move in solid train loads over extended distances can be carried at lower rates per ton per mile than those that move in separate carloads on trains that carry various kinds of freight, or in less than carloads. Therefore, the lowest rates are made on the commodities which move in the great channels of traffic to the great consuming and distributing centres. These great industrial and commercial centres had their origin in the natural advantages of geographical location: Boston, New York, New Orleans, Galveston, San Francisco, because of their harbors; Pittsburgh, Cincinnati, Chicago, St. Louis, because of their location on the inland waterways.

The trend of the early railroads was naturally to and from the existing centres which consumed and supplied traffic in the greatest quantities. In later years the site of extensive manufacturing plants, and therefore of considerable communities, has been in large part determined by the relative location of raw materials and markets. For traffic to and from all such centres the greatest number of railroads have competed.

The rate wars brought on by this competition have resulted in adjustments which are fairly stable in the portions of the country of earlier development and denser population; but they are so closely interwrought as to be in a condition of most sensitive equilibrium. For example, "by reason of the volume of traffic that flows between them, the rate between Chicago and New York is the basis to which practically all the rates east of the Mississippi and north of the Ohio Rivers are adjusted. The rates between New York and Chicago, which are the result of contests that have been fought to a finish by the railroads and the communities concerned, are designated as one hundred per cent rates. The rates to and from intermediate cities and territories have also been arrived at through contest and compromise, and are established as percentages of the one hundred

per cent rate. That is, the rate from New York to Pittsburgh is sixty per cent., to Cleveland seventy-one per cent., to Detroit seventy-eight per cent., to Indianapolis ninety-three per cent., Peoria one hundred and ten per cent., and to St. Louis one hundred and sixteen per cent. of the New York-Chicago rate. By arbitration and other adjustment the rates to and from Philadelphia and Baltimore bear a fixed relation to the New York-Chicago rate. Rates from Boston and interior New England points; rates from the territory surrounding Buffalo and Pittsburgh, and from other interior points, are established in relation to the New York-Chicago rate, as well as rates to and from Norfolk and other points in Virginia. Rates in the opposite direction, that is from Chicago to New York, are also considered as one hundred per cent, upon which basis are likewise made practically all the West to East rates from points on the Mississippi and Ohio Rivers, and the territory north and east thereof.

If therefore a railroad rate upon an article of general production and consumption is reduced between an Eastern and a Western point in the territory specified, the equities and rivalries of other producing and consuming localities, and the competition of carriers produce the following results:

(1) All railroad rates are reduced between all Eastern and all Western points, in the territory described.

(2) Rates for combined rail and lake transportation are reduced.

(3) Rates via the Erie Canal and the Great Lakes are reduced to maintain the difference between them and the all-rail rates, and the rail and lake rates.

(4) Rates on through traffic from and to points west of the Mississippi River, and from and to points south of the Ohio River, are reduced.

(5) Rates may be reduced to and from points in Canada.

It has been estimated that a change in one of the rate bases mentioned has forced the changing of not less than eight thousand rates.

Upon the sixty per cent. of the Chicago-New York rate fixed for Pittsburgh are based,—as the result of many years of controversy between competing manufacturers, and rate wars between the railroads serving the several districts,—the fixed differences for rates from the Mahoning and Shenango Valleys, which are forty cents per ton higher than the Pittsburgh rate; from the Cleveland district which is sixty cents per ton higher than the Pittsburgh rate; and from the Johnstown district,

which to the East is thirty cents per ton less than the Pittsburgh rate. The rates on the raw materials that enter into the manufacture of pig iron—coke, ore and limestone—to the Pittsburgh, the Mahoning Valley, the Shenango Valley and the Wheeling districts are so delicately balanced that a change in the rate on ore, coke or limestone to either of these districts, would necessitate a change in the rates on these commodities to the other districts, or else a change in the rate on the manufactured iron and steel from the districts in which the rates on the raw material had not been adjusted. Likewise a serious reduction in the rates on the products of the furnaces at South Chicago and Joliet, will necessitate changes from the Pittsburgh district, and therefore from the Wheeling, Mahoning Valley, Shenango Valley, and Cleveland districts.

The adjustment of rates to and from points in the territory south of the Ohio and east of the Mississippi Rivers, depends not only upon the rates that are made from the West to the crossing points on the Mississippi and from the North to Cairo, Evansville, Louisville, Cincinnati and other crossing points on the Ohio River, but on the rates by water from New York and Baltimore on the East, and on rates from New Orleans and Mobile

in connection with the water lines to those points. What follows the changing of one important rate in this Southern territory, is exemplified by the following statement of what happened as a consequence of a recent change in rates from Baltimore to Atlanta, and Louisville to Atlanta. Rates corresponding to the reduction from Baltimore were made from Boston, New York, Philadelphia and the other Eastern seaports, as well as from all interior Eastern and New England cities to Atlanta. Reductions corresponding to that from Louisville were made from Cincinnati, Evansville, Cairo and Memphis. These reductions from the Eastern seaports and the Ohio and Mississippi River crossings, necessitated a reduction in the rates from every point in the United States north or west of these gateways, and likewise a relative reduction from Virginia cities to Atlanta, and reduction from the South Atlantic ports of Norfolk, Charleston, Savannah, and Brunswick. The changes in these rates to Atlanta forced corresponding change to the neighboring city of Nashville, and a proportionate reduction to Chattanooga, Macon, Columbus and other cities in Georgia. The change at Chattanooga in turn affected rates from Florence, Sheffield and Decatur; from Knoxville, Montgomery, Selma and Birmingham, as well as from New Orleans and

Mobile. This change in the rates to Atlanta also ramified throughout Virginia and the Carolinas, the total changes necessitated by the initial change being not less than a hundred thousand.

Another traffic current which affects rates throughout a wide territory, and in multiple ramification, is that between Chicago and St. Louis and New Orleans. The roads tributary to this port naturally work to develop its traffic, with the result that lines leading from the grain and grazing regions of the West to the Atlantic seaports have had to make certain revisions in their rates. A reduction in the grain rate made in January of last year from Kansas City to Galveston forced reductions in rates on grain from the territory beyond and via Kansas City and Omaha, not only to New Orleans, but to New York and Baltimore: reductions were also forced to New Orleans from all stations in the grain raising States of South Dakota, Iowa, Minnesota and Illinois.

Changes similar to those that have been specified, as following the modification of a rate from Louisville to a Southern point, also follow the change in a rate from St. Louis to New Orleans or other Southern distributing point. In such a case the ramifications begin at Buffalo and Pitts-

burgh and extend westward to Arkansas, Indian Territory, Oklahoma and New Mexico, affecting the rates from these regions to points south of the Ohio and east of the Mississippi Rivers.

Changes in rates that affect New Orleans and other points in Louisiana, also affect the rates to and from Texas, the present adjustment of rates to and from Texas and Louisiana being as delicate as that in other regions of the South where, as we have seen, a reduction in one rate may demolish the entire structure.

The growth of population in the Mississippi and Missouri Valleys has brought about a development of industry and commerce that causes an extensive interchange of traffic between the communities that range from Minnesota and Wisconsin to Tennessee and Arkansas, and from the Dakotas to Colorado and Oklahoma. It is obvious that to and from many places in these regions, traffic can cross the Mississippi or Missouri Rivers at any one of several gateways. Therefore has grown up a rate adjustment for this traffic, the interdependence of which may be illustrated by a reduction in the rates on buggies, carriages and spring wagons recently made from Freeport, Illinois, to points in Iowa, which immediately brought about corresponding reductions from Milwaukee, Racine, Madi-

son, Janesville, Beloit, Wisconsin, Kankakee, Bloomington, Decatur, and other points in Illinois to all points in Iowa and Wisconsin. These reductions spread from all shipping points east of the Illinois-Indiana State line to all points west of the Mississippi River. A reduction in the rate on wire and nails from Chicago to Denver brought similar reductions from other Illinois to all Colorado points, and had the effect of reducing the rates on wire and nails eastbound from the Colorado mills through all of the Missouri River gateways. The inter-relation of rates in this region may be summarized by the statement that a change in a rate between St. Louis and either Kansas City, St. Joseph, Atchison, Leavenworth, Nebraska City, Omaha or Council Bluffs immediately changes the rate to each other of these Missouri River gateways, and automatically reduces the rates between Memphis, St. Louis, Peoria, Chicago, St. Paul, Duluth, Sioux City, Sioux Falls and all points between the Missouri River and the Rocky Mountains.

The rates from St. Louis to St. Paul and Minneapolis are on an established basis, attained through compromise after the customary period of warfare, of one hundred and five per cent of the rates from Chicago to St. Paul and Minneapolis.

The Chicago rates apply through Illinois as far south as Peoria, Decatur and Springfield. The rates from Chicago and Des Moines are made a percentage of the rates from St. Louis to Des Moines, and the rates from Chicago to interior points in Iowa, such as Cedar Rapids, Ottumwa and Marshalltown, bear a fixed relation to the rates from Chicago to Des Moines. The rates from St. Louis to Des Moines are fixed upon the rates from St. Louis to St. Paul and Minneapolis. Therefore, a reduction in a rate from Chicago to St. Paul and Minneapolis would result in a corresponding change from St. Louis to these cities, which in turn would change the rate from St. Louis to Des Moines, which would change the rate from Chicago to Des Moines, and likewise the rates from Chicago to Cedar Rapids, Ottumwa and Marshalltown.

The complications that beset the making of rates between the regions east of the Rocky Mountains have their effect upon the rates to and from the Pacific Coast, which also must be kept in certain adjustment with the ocean rates. A change in the through rate via any route from any place of production in the East necessitates a change via any other route to any seaport competing with another seaport for the trade of

the interior. Likewise with the rates from the Pacific Coast. For example, canned, dried and green fruit and vegetables produced in California, Oregon and Idaho, compete with one another not only in the West, but pretty much throughout the United States and in certain parts of Europe. A change in the rate on any one of these commodities, via any route from any producing centre, would bring about corresponding changes via other routes from the same and other producing centres.

As another example, sugar is produced and refined in Texas and Louisiana and also in Colorado, Utah, Idaho, and in California; sugar from Cuba is imported and refined at New York and Philadelphia. All of these places of production and refining compete for the markets of the Mississippi and Missouri valleys. Therefore a change in the rate on sugar from California to a Missouri Valley distributing centre, would likely cause a change in the rate on sugar from New York, Philadelphia, Utah and Colorado. A change in the rate on any commodity from St. Paul to Butte, a distributing centre of Montana, would cause a change in the rate from every crossing point on the Missouri River to the distributing points not only in Montana, but in Utah and Idaho.

In short, the merchants of Chicago, St. Louis, St. Paul, Duluth, Sioux City, Omaha, Kansas City, Denver, Salt Lake City, Butte, Spokane, Seattle, Tacoma, Portland, San Francisco, Los Angeles, Galveston and New Orleans, are all competing to a greater or less degree for the trade of the entire territory between the Mississippi River and the Pacific Ocean. The rate adjustment now existing is the result of experience, of competition between carriers, competition between communities, competition between the producers and between the distributers. Changes are constantly being made to meet the fluctuating conditions of industry and commerce, that in this region are peculiarly and intensely dynamic.

For the grazing grounds that range from the Canadian boundary to the line of the Union Pacific Railway, Chicago is the controlling market. If the rate for beeves from any point in this vast region to Chicago is reduced, corresponding reductions must be made from the adjoining points, and these reductions affect the rates from all other points on the various railroads leading from that territory. As the cattle are on the hoof and can be shifted from one end of a range to another, often over a distance of two or three hundred miles without damage or increased expense, this

shifting can readily be made to a station on a road which has reduced its rates, and away from the railroad that has not made a corresponding reduction. An attempt to adjust live-stock rates through the Interstate Commerce Commission necessitated the inclusion in the complaint by certain of the live-stock interests, of all the railroads between Canada and Texas. But be it said that the complaint was far from unanimous, many shippers expressing entire satisfaction with the status.

A beautiful example of competition arose out of the extraordinary demand for flour in China and Japan during the recent conflict. Enormous purchases were made from the Minneapolis millers who were quoted rates via the Atlantic seaboard and the Suez Canal. The railroads leading to the Pacific Coast were enabled, by the necessity of transporting cars to the Coast to bring east products of the Northwest and of the Orient, to quote the low rates necessary to secure shipments of this flour from Minneapolis to the Orient via Puget Sound. This rate, established solely to obtain this particular and temporary traffic, was so low as to cause the millers and farmers at interior points on the Pacific Coast to demand correspondingly low rates on their shipments for domestic consumption on the Coast. As it was impossible to grant their request

the low rates from Minneapolis were withdrawn.

The exposition just made applies to that interdependence of railroad freight rates which grows out of the competition between railroads, between communities, between producing centres and markets. There is another phase of this interdependence which grows out of the relation and competition between commodities themselves. It is a general principle that crude or raw materials should, other things equal, pay lower railroad rates than the products manufactured therefrom. Therefore, for example:

(1) Rates on pig iron are lower than rates upon steel billets, blooms and ingots, which rates in their turn are lower than those upon finished iron or steel products.

(2) Animal hides are accorded lower rates than leather.

(3) Wool and cotton are accorded lower rates than woolen and cotton fabrics.

(4) Rates on live-stock are less than on dressed beef, and on hogs less than on hams and other provisions.

(5) The rates on ore are less than on bullion and mattes.

(6) Rates on lumber are less than on products manufactured therefrom.

(7) Rates on denims are less than on overalls and jumpers.

It therefore follows that a change in the rate on a finished product, or on a raw material which is a factor in its production, may necessitate changes on the other kinds of raw material and on the finished product. For example, a change in the rate on lumber would result in a corresponding change on articles taking lumber rates, such as laths, shingles, telegraph and telephone poles; and upon articles manufactured from lumber and taking higher rates, such as sash, doors, blinds and interior finish; or as another example, a change in the rate on sulphur to paper manufacturing points, would result in corresponding changes on other articles of paper stock, such as brimstone, caustic soda, kaolin, copperas, potash, soda ash, resin, ground clay and ground rock.

That competition known in economics as substitution, the use of one commodity in the stead of another if there is too great a variant in the price, compels the railroads, in behalf of established industries, to maintain a certain relative adjustment in the rates on competing commodities, for example, as follows:

(1) Soap, soap extracts, soap powders, washing compounds, washing powders and washing crystals,

all of which are used for cleansing purposes and are commercially competitive.

(2) Glue (animal product), destrine (vegetable product), casein or milk curd (animal product), all of which are adhesives largely used for manufacturing purposes and directly competitive.

(3) Hemp, sisal, manila and jute, all vegetable fibres directly competitive in the manufacture of rope and twine.

(4) Strawboard, wood pulp board, binder's board, box board, news board and chip board.

(5) Corundum, carborundum and emery.

(6) The different kinds of paint.

(7) The different kinds of paper.

(8) Copper wire, copper rope, copper cable, insulated wire, insulated cable.

(9) Wrought iron pipe, cast iron pipe, all iron steel tubes.

(10) Rolled oats and all cereal foods.

(11) Raisins, dried prunes, dried peaches, dried apricots, dried pears.

(12) Canned salmon and all other canned fish.

(13) Canned fruits and canned vegetables."

The system whereunder the rates between Chicago and New York are designated as one hundred per cent. rates, and the rates to and from other points intermediate to and beyond these

cities are made a percentage of these rates, was devised by James McGraham, a clerk in the freight department of the Pennsylvania Railroad. It not only vastly simplified the making of tariffs, but removed the complications that theretofore had beset the determination of a rate that should apply from a point common to two or more routes, via either of those routes to another common point. For example, traffic from Indianapolis can go to New York by way of Cleveland and Buffalo; Dunkirk and Salamanca; Columbus and Pittsburgh; or Cincinnati and Parkersburg, the rate made on the usual basis via either route differing from that via the others. When the rate from Indianapolis to New York was made ninety-three per cent of the Chicago rate this source of friction was removed.

A city such as Chicago or New York, to which the through rate is a factor in determining the rate to a point beyond, is designated as a "basing point,"—that is, the through rate to the basing point is added to the rate from the basing point to the point beyond; or as we have seen, the rate to the point beyond is made a percentage over the rate to the basing point. The commercial centres are all or nearly all basing points, and so also are usually the termini of the roads that extend to the boundaries of the great commercial divisions

of the United States, whether these termini are great commercial centres or not. That is, for example, not only are Louisville and Cincinnati basing points, but so also are Evansville and Henderson; not only are Chicago and St. Louis basing points, but so also are Peoria, Davenport, Dubuque and Sioux City; not only are Omaha and Kansas City basing points, but so also are St. Joseph and Leavenworth.

As the through rate from commercial centre to commercial centre, determined by competition and by reason of the fact that commodities move in solid train loads through these channels of vast traffic, is always lower than the rate where such conditions do not prevail, it is evident that the basing-point system gives to all points lower rates than they would have if the rates thereto were not made on the basing-point rates. Not only are the great commercial centres and the gateways between one section and another basing points, but intermediate commercial and distributing centres of less importance are minor basing points. For example, as has been stated, Des Moines is a minor basing point, the rates to which are dependent upon the rates between Chicago, St. Louis and St. Paul.

The system of group rates, and rates made upon

basing point rates, has therefore tended to decentralize the traffic of the United States. Critics of the rate structure of this country, which has been a natural development to meet the commercial needs of the country, have argued that rates should progressively become less per mile as the distance increases. Such a system is in effect in Australia, and its natural result is to concentrate the commerce of the country at the great seaports. That is, for example, as the rate from Melbourne becomes less per mile with the distance, a merchant five hundred miles in the interior can obtain merchandise at a less rate from Melbourne, than if it were shipped from Melbourne to a distributing point four hundred miles in the interior, and from there reshipped to the retailer. Under the latter arrangement the rate instead of tapering all the way would begin at the highest rate per mile at the interior or distributing point. Were this system in effect in the United States, the only distributing centres would be the great seaports like New York and New Orleans, or the great manufacturing centres like Pittsburgh and Chicago. Such commercial centres as Indianapolis, Des Moines, Little Rock, would not exist; the country would not be covered with distributing centres, from which radiate the principal and the minor

channels, through which there is a flow of commodities to the hamlet and the farm.

Akin in its effect to the tapering system is the zone tariff of Hungary. As the rate becomes progressively less per mile to the different zones of which the capital is the centre, the natural effect has been to develop and build up Buda Pesth.

That the adjustment of railroad rates necessitates the specialized and continual study of the traffic to and from all portions of the United States has been made manifest by the foregoing exposition. There certainly has been shown the necessity for a staff of traffic officials of each railroad, who from the traffic manager to the traveling agent and station agent, are incessantly in touch with the conditions upon which these adjustments are based; and are continually collecting the information which leads to readjustment after readjustment, with less of contest and commercial disturbance, just as differences between nations are settled more and more by mutual recognition, by discussion and compromise, and less and less by war.

It cannot be contended that the present rate structure is in a state of perfection. It is subject to frequent variation because of the continually changing incidence of the conditions upon which it rests. It is, moreover, the work of men who

are but human, who have had to develop a new transportation status under the pounding of industrial and commercial forces that during the last century have surged and seethed as at no other time in history. It sometimes happens that a rate readjustment necessitated by a change in commercial conditions is not immediately traced throughout the full measure of its logical ramifications, and discrimination may thereby for a time work against communities and persons. In that railroad managers are human, they have not at all times subordinated personal greed to the interests of their companies and the communities served by them. There have been opportunities for personal aggrandizement through direct aggression and through underground stealth. But that force which makes for righteousness works through the administration of the railroads as it does throughout all civilization. The errors and misdeeds of the past and the relatively unimportant delinquencies of the present should not blind us to the magnitude and fairness of the achievement as a whole.

In this country, under the genius of our institutions, the freight rate has been determined by the action and reaction of commercial forces, with the result that the rate of freight has decreased from

18.89 mills in gold per ton per mile in 1870 to 7.80 mills per ton per mile in 1904, the slight rise of little more than seven per cent. since 1889 being much less than the average increase of from twelve to fifteen per cent. in the cost of railway labor, and twenty-five to thirty per cent. in the price of materials consumed in railway operation. Under these rates, which are far lower than are elsewhere known, are brought to the doors of the people of the United States, high and low, rich and poor, commodities in greater variety and volume than to the people of any other nation on earth. The passenger mileage per capita increased from 114 in 1880 to 260 in 1903, the ton mileage per capita from 645 to 2155, and there is hardly a commodity, if indeed there is one, a given quantity of which will not purchase more railroad transportation at this time than then: there is not a day's labor of any kind that will not purchase a greater amount of railroad transportation now than then. That is, for the price that can now be obtained for a given quantity of any commodity, or for the money now obtained as a day's wage, there can at this time be purchased transportation, for either a person or a ton of freight, over a greater number of miles than in 1880 with the price that could then have been obtained for that given

quantity of any commodity, or with the wage then obtainable for a day's labor.

The principles underlying the making of rates which have been but crudely outlined, are given application under the direction of the general traffic officers by a corps of rate clerks, who work out the tariffs in detail and furnish them to the station agents for their guidance in making charges. Every agent has tariffs showing the classification in which each of the commodities that enter into traffic has been placed, and the rate per hundred pounds between different stations; he also is furnished with tariffs showing modifications of this general tariff for particular commodities and to particular places. The rates that are normally furnished an agent are of course for articles that are likely to be shipped from his station and to particular destinations. An agent, for example, in Minnesota, can doubtless quote instantly a rate on wheat to Massachusetts, and an agent in Massachusetts a rate on shoes to Minnesota, but the agent in Minnesota probably could not quote a rate on shoes to Massachusetts, nor the agent in Massachusetts a rate on wheat to Minnesota, without communicating with the division or general freight agent.

When an agent receives a consignment of freight, he issues a bill of lading to the consignor

as a receipt, and as a contract for the shipment. He retains a duplicate from which he makes out, when the consignment has been loaded into a car and is ready to be taken away, a waybill, or as it is sometimes termed, a manifest, which describes the shipment and the car in which it has been loaded, specifies the shipping point and destination, the consignor and consignee, the rate and whether or not the charges have been paid in advance or are to be collected at destination. A copy of this waybill is given to the freight conductor, who gives the station agent a receipt for the consignment. He delivers the waybill to the agent at destination, who receipts to him for the consignment. At the place of destination a freight bill, containing a description of the shipment similar to that of the waybill, and showing in addition the total charge collected, or to be paid, is rendered to the consignee, and his receipt is taken for the shipment when it is delivered.

If no one ever made mistakes, the handling of freight from the time it leaves the consignor until it is delivered to the consignee would be simple enough. But in the millions of freight transactions that are entered into every year by any of the large railroad companies, there is a sufficient proportion of errors to cause the maintenance, usually

as an adjunct of the general freight office, of a freight claim bureau, which traces and adjusts claims for commodities lost in transit, damaged by exposure to the weather, spoiled from delay or lost by wreckage; and also adjusts claims caused by excessive charges made through errors of the shipping or receiving agent.

The principles that underlie the adjustment of freight rates also apply to the adjustment of passenger rates, in that it is to the interest of a railroad company to so adjust passenger rates that they will stimulate the largest volume of traffic, the total of which will yield the greatest proportion of net revenue. Those whose journeys are infrequent, and cannot be counted upon at any particular time for any particular train, should obviously pay a higher rate per mile than those whose frequent journeys make them constant patrons, and especially than those who can be counted upon with regularity to use particular trains. That is, the man who travels once or twice a year from Harrisburg to Columbus should pay more than a merchant who makes an extended round among his customers three or four times a year, and a still lower rate per mile should be made to the man who with his family is a constant patron of the trains between a city and a suburb. Therefore,

the regular local fare, which in most parts of the country is at the rate of three cents per mile; the mileage ticket, which is usually at the rate of two cents per mile; and the commutation ticket, which is often sold at less than one cent a mile. As the object of these differences in rates is to stimulate the travel of those who can be induced to travel frequently or, to put it another way, to give the lowest rates to the largest consumers of travel, it is obvious that the fulfillment of the purpose requires the limiting of the concession to the use of the individual to whom it is granted. Therefore have arisen the restrictions as to the use of mileage, commutation and other non-transferable tickets.

As it is between the large industrial and commercial centres that commodities are shipped in largest volume, so also is it between these centres that there is the greatest volume of passenger traffic, the one condition in large measure causing the other. As the patronage of the through trains between such centres is fairly constant and on the average predictable, lower rates can be made for such traffic; and such lower rates have also in large measure been forced by the competition which has waged as fiercely for passenger traffic between these centres as it has for freight traffic. As the

spirit of such concessions is to encourage traffic between centres specified, the tickets are usually restricted for continuous passage from one place to the other, the privilege of stopping off at intermediate places pertaining only to ordinary tickets sold at full fares.

The lowest passenger rates, other than for regular commutation travel, are made for a large number of persons, who under an arrangement made in advance can be counted upon for a specific train. Of such are the excursion rates for special excursion trains, which enable many to have the benefit of an outing and change of scene, who otherwise would probably never travel at all.

To provide for the various kinds of travel there are various kinds of tickets which are furnished from the general ticket office to the station agents to be sold at rates of fare prescribed by the general passenger agent. A ticket, after delivery to the passenger by the ticket agent, is taken up from the passenger by the train conductor: if it read for passage over more than one railroad, a coupon is taken up by the conductor of each railroad.

In the early days of railroads it was attempted to make a charge for the transportation of the belongings which a passenger carried with him, it being considered that the ticket fare called for the

transportation of a person only. The competition between the different railroads, however, led to the carrying free of a passenger's wearing apparel and other necessaries; and it was finally held by the courts that a contract to carry a passenger included by implication the carriage of the clothing and other immediate necessities of the journey. Custom, confirmed by the ruling of the courts, has placed the limit of one hundred and fifty pounds of baggage to be carried free per passenger as reasonable. This carrying of baggage and the system under which it is checked, have given rise to the baggage department, a subdivision of the passenger department, under the charge of a general baggage agent who issues baggage checks to station agents and instructions regarding their use.

It is to be hoped that the presentation of rate making problems contained in this lecture, which necessarily is only in outline, is nevertheless sufficient to demonstrate, what is the actual fact, that rates are adjusted in accordance with commercial conditions and that their determination is through the traffic offices. A question in regard to this adjustment is but infrequently referred to the president, and seldom or never to the board of directors. The oft repeated charge that rates are held up to pay dividends on fictitious capitalization is without

foundation. The truth is that their adjustment is, and necessarily must be, entirely without regard to capitalization.

IV

ACCOUNTING AND STATISTICS

It has been barely more than a century since the practice of the English speaking shopkeeper in keeping track of what a customer owed him, was to make a mark on the wall for each penny's worth or shilling's worth, as the case might be, of merchandise sold: when nineteen of these marks had been made, the next was a cross mark indicating the completion of the "score," and the customer was then expected to settle. Another method was by splitting a flat stick like a lath lengthwise into two parts. When these parts were placed together, a knifecut made a corresponding notch in both, thereby providing a record for the customer as well as for the shopkeeper. This custom was brought from France where it was called the Taille. When the notches reached twenty the customer was expected, in the language that then was literal but is now figurative, to "pay the score." The records of the English tax gatherers were kept by means of these tally sticks, and the fire in 1835 that destroyed the Parliament buildings arose from an old store room in which bundles of these sticks turned in by the tax gatherers were kept.

It will be seen from this that even the system of single entry bookkeeping, whereunder an account was kept simply of moneys received and moneys expended, was only coming into general use at the beginning of the nineteenth century, which was well advanced before the introduction of the double entry system, whereunder every transaction is shown in its twofold debit and credit aspect. It is obvious that money cannot be paid unless something has been received for it: the cash account is therefore credited, for it has produced something; and the account showing the purchase is charged, for money has been spent because of it. Likewise money cannot be received unless something has been parted with for it: the account showing the purchase is therefore credited, for it has produced something; and the cash account is charged, for money has been placed in it. As late as the forties there were essays in the magazines and newspapers dwelling upon the new found beauties of this wonderful system, and discussions of its perplexities.

It is evident therefore that the railroad companies, the first of the great modern organizations to operate over extended territory and enlist large forces of employes, have had to develop from the foundation an accounting system characteristic of and suitable to the conduct of the transportation

industry. The outline of the history of the Baltimore and Ohio Railroad Company showed that at first under the organization of 1829 the auditing of accounts was made a part of the duties of the master of transportation: the organization adopted ten years later transferred these duties to the secretary. The progress of the accounting function from this inferior status into an independent department, that to-day on all the large railway systems is recognized as of co-ordinate importance with the departments of operation, traffic and finance, has been through gradual development. The justification of its present status is disclosed by an examination of what it does, why and how it does it.

In the transactions of even the humblest citizen it is necessary for him to count the money he receives and the money he pays out. If he is careful he tests the prices that he pays for what he buys, and sees that he receives what he pays for. This is not only to guard against dishonesty but to guard against error on the part of those with whom he has transactions. As a man becomes concerned with affairs that extend beyond his own immediate personal wage and expenditure, and particularly as his administration widens to responsibility to others, there is the necessity for

an extension of this same prudence to each phase of his administration. That is, he must account for that which goes out and that which comes in. He must see that he pays no more than is proper for that which is purchased and that he receives what is proper for that which is sold. He must see that in quantity and quality he receives what he has paid for. He must see that that which is purchased is used for the purpose intended; that is, that it is accounted for. He must see what relation that which is paid out because of each incident of the operation bears to what is received because of that incident. That is, he must know how much is gained or lost by reason of each phase of the operation, and he must know what is the final gain or loss of the operations as a whole for any given period.

The procedure of an accounting department to achieve these purposes necessarily includes provision for its scrutiny, before payment, of all bills whether for material and supplies, for wages and salaries, for rentals or taxes or for other expenditures of whatever nature.

It is manifestly impossible that any one man or set of men working at desks in an office, should know of their own immediate cognizance that material of just the right quantity and quality has

been purchased, and at the proper price; that no more men are employed than is necessary, and that their wage is properly adjusted; that the bills for all other expenditures are just what they ought to be. The accounting officer can, however, see that every bill for material or supplies bears the certificate of the responsible officer that it has been needed; that it has been purchased at proper prices; that the quantity and of the quality specified has been received.

This certification is provided on a document designated as a voucher: that is, the document vouches for the due authorization and the accuracy of the items covered by it. For example, the procedure leading up to a voucher for steel rails may be about as follows: A supervisor reports to his division engineer that he will need so many tons of steel rails. The engineer adds this quantity to that reported by other supervisors and makes requisition through the proper channel upon the general manager, who after scrutiny and emendation, authorizes the purchasing agent to buy the total quantity requested by the various division engineers. The purchasing agent places the order, his inspectors inspect and count the rails as they are received from the mill and again when distributed among the various divisions to the several

supervisors. The voucher covering this purchase that comes to the accounting department, will bear the approval of the general manager, and the certificate of the purchasing agent. If the entire quantity of the rails has not been distributed at once, but a portion or all of them consigned to a store house, record is made accordingly in a stock book in which note will be made of their supply to whatever division and of their use, advices of such disposition being forwarded to the accounting department at the time of transfer. This procedure is indicative of that in connection with the purchase, storage, and distribution of supplies of whatever kind. The Accounting Department keeps a record of all supplies received and of where and for what purpose they are used.

Payments for services are similarily authorized. The rate of pay of various officers and employes, and the amount or time of service rendered are listed on payrolls, each of which is certified by a superior responsible for the employment of the men named on the roll, and by the head of the department.

On the back of each voucher is a tabulation showing to just what departments, sub-departments, and specific structures or purposes the different proportions of the expenditure covered by

the voucher or payroll are chargeable. Each voucher is given a consecutive number and entered in a record, upon which under different headings corresponding to those of the tabulation on the back of the voucher, the proportions, or, as it is termed, the "distribution" of the expense is entered, the several items of distribution necessarily aggregating the sum total of the vouchers entered for a given period. This voucher record therefore shows the total expenditures for any given period, and the purposes to which those expenditures have been applied. The authority for any particular expenditure can be ascertained by reference to the voucher bearing the consecutive number as listed on the record, and in the order of which it is filed.

This working of the accounting department in connection with expenditures, requires the services of a corps of clerks, whose efforts are directed and co-ordinated by an officer, who by the larger railway companies is usually entitled the Auditor of Disbursements.

In ascertaining that proper compensation is received for all transportation sold by a railroad company, it is necessary that the accounting department see that for every ticket sold there has been obtained the proper rate; that each ticket agent account for every ticket supplied to him;

that of the money received for each through ticket sold by another line, his company receives its proper share; and that of the money received for each through ticket sold by the company for passage over other lines, each of those lines receives its due share. The procedure whereunder the accounting department keeps check upon tickets and ticket revenue is in outline as follows:

The preparation and printing and distributing of tickets to agents for sale, is under the jurisdiction of the general passenger agent, or general ticket agent, or the general passenger and ticket agent as he is sometimes designated. This official decides what kinds of tickets shall be on sale at each ticket office, and renews the supply upon the requisition of the ticket agent. Each ticket bears a consecutive number, which in the case of a local ticket in connection with the designation of the transportation for which it calls, describes and distinguishes it. Thus, for example, there may be furnished to the agent at Camden Station on his requisition, single trip tickets, Baltimore to Philadelphia, numbers 21000 to 21999—1000 tickets; or mileage tickets 1600 to 1699— 100 tickets; or monthly commutation tickets between Baltimore and Washington, numbers 2050 to 2099—50 tickets. Each through ticket, or in other words a ticket sold by

one company for passage over the lines of other companies, consists of a separate part or coupon for each line to be used; and, in addition to the consecutive number, bears a "form" number indicating the route over which it calls for transportation. This form number, the consecutive number and the destination serve to describe and distinguish it. For example, Form 600 might indicate a ticket issued by the Baltimore and Ohio Railroad Company calling for transportation to Chicago, thence over the Chicago, Milwaukee & St. Paul Railway to Saint Paul, thence over the Northern Pacific Railway to a station on that line: there might be furnished to an agent on his requisition, Form 600—Northern Pacific—numbers 3050 to 3099—50 tickets. With each lot of tickets furnished the ticket agent by the general ticket office, is an invoice describing the tickets and specifying the consecutive numbers. The agent retains a copy of this invoice, and signs and returns the original to the general ticket office as a receipt. The general ticket office forwards a duplicate of the invoice to the accounting department, which charges the tickets specified thereon to the account of the agent.

The agent reports periodically—generally monthly—to the accounting department all tickets

sold by him, specifying the form, consecutive numbers, each separate destination and the moneys received therefor. The accounting department checks the report with the tariffs furnished by the general passenger agent to see that the correct rates have been received, and the total amounts. The ticket agent also makes periodically to the accounting department a report of the tickets on hand, which of course should include all tickets furnished by the general ticket office, less those that have been sold and so reported.

Distribution of the money received for a through ticket is made among the different roads over which it reads in accordance with agreed divisions of the through rate, which are furnished by the passenger department to the accounting department. Settlements of balances with the different roads are made monthly by draft.

In the accounting department are also assorted all tickets collected, as they are turned in by the train conductors. They are scrutinized to see that they have been properly sold by the agents, properly cancelled by the conductors, and to guard against possible misuse and counterfeits they are checked against the agents' reports of tickets sold. The coupons of the tickets issued by other roads are checked against the reports of those

roads to see that proper report has been made of all tickets collected.

This procedure in connection with the auditing of revenue obtained from ticket sales, is performed by a corps of clerks, who in the organization of the larger railroad systems are under the direction of an officer entitled the Auditor of Passenger Revenue, or an equivalent designation.

In fulfillment of the function of ascertaining that proper compensation is received by a railroad company for all freight transportation sold by it, it is essential that the transaction covered by each bill of lading or contract for carriage be carefully checked.

To this end a list designated as a waybill or manifest is made for each shipment, on which is shown the name of the station at which the shipment originated, its destination and route to be traveled. There is also shown in addition to the date and car into which it is loaded, the shipper, the consignee, a description of the packages or articles, weight, rate and freight charges. A copy of each waybill is forwarded to the accounting department, where a careful examination is made of the classification, rate and total revenue. The original waybill after delivery to the agent at place of destination, is, after the freight bill to the con-

signee has been rendered and paid, and the shipment delivered, either forwarded direct or a report of it made to the accounting department, which thereby is enabled to check the record of the waybills returned by the forwarding agents with the record of waybills accepted by the receiving agents. It will be perceived that the total of the items of the waybills forwarded from one to another station, should agree with the total of the same items of the waybills received at the other station. Therefore the accounting department obtains a check upon the aggregate of shipments by checking once a month the total revenue on freight forwarded from each station, against the total revenue on freight received from that station at all other stations: or in other words, the total revenue on freight received at all stations must balance with the total revenue on freight forwarded from all stations.

As freight charges may either be prepaid at place of shipment, or be paid by the consignee at place of delivery, the accounting department must keep careful record of the charges and credits to agents.

The settlement between one railroad and another for freight originating on one road and passing over the line of one or more other roads, was until within the last eight or ten years, in most cases

adjusted under the custom formed in the earlier days before an accounting system had really developed, when there was no accounting department deserving the name. The simplest and surest way at that time for a railroad to obtain its charges for a freight shipment, was not to let the shipment pass out of its possession, until it had received its share of the charges. Therefore the agent of a railroad receiving a consignment of freight from the agent of another railroad, paid to that agent the proportion of the freight charges accruing to the junction point: or if the shipment were prepaid the first road retained its proportion of the through rate, and paid to the agent of the second road the remainder, and so on.

Although this method was modified by provision for weekly settlements by draft, instead of immediate cash settlements, it obviously is objectionable in that it compels the junction station agent to be charged with disbursements as well as receipts, obliges him to perform the duties of an accountant in checking and adjusting the division of the revenue, compels the freight traffic officer to furnish each station agent with the divisions at the same time he furnishes him with a through freight rate, and also complicates the work of the accounting department in checking

the disbursements and receipts between one road and another through their respective agents. Through the efforts of the Association of American Railway Accounting Officers there has been extended and improved a system designated as Interline waybilling, formerly in use to a limited extent between certain of the large railroads, whereunder the re-billing and settlements at intermediate junction points are avoided. Under this system the total moneys received for a through shipment are turned into the treasury of the receiving road, and settlement is made with the various roads participating in the shipment, in much the same manner as settlement is made between the different roads participating in carrying a passenger on a through ticket. A copy of the original waybill is sent to the accounting department of each road, where it is checked against a report of the shipment made by the road receiving it. The original waybill is carried through and delivered to the agent at the destination of the shipment. The final road verifies and examines the original waybill, and advises the accounting departments of the several roads over which the shipment has passed of any changes or corrections. The through rate is apportioned, generally by the final road, between the different roads over which the shipment has

passed, in accordance with agreed divisions furnished by the general freight agent, and drafts are made for balances. Under this system, which is rapidly extending throughout the country, the movement of freight is far more expeditious than under the old system, which often entailed delay at the junction point.

The procedure in connection with the checking of waybills, the collection and apportionment of the revenue arising from freight shipments, is entrusted to a corps of clerks who form an organization under the direction of an officer usually designated the Auditor of Freight Revenue.

In the pursuance of his duties in the sale of tickets, and the issue of bills of lading and waybills, it is necessary for each station agent to keep a record of tickets on hand, tickets sold and cash received, of bills of lading and waybills issued; of money received for freight charges and moneys advanced to connecting roads. These records should at all times show the exact status of the station accounts, and the cash on hand, of which the agent is required to render monthly balance sheets and accounts current. To verify these station accounts there is a corps of traveling auditors, one or more of whom at an unexpected time visits a station, carefully checks its records and

verifies the cash account, taking practical charge of the accounts of the station while the check is in progress.

Another function of the accounting department is the making of settlements with other railroads upon vouchers originating with the mechanical department, for repairs to cars made while not on the line to which they belong; and for the use of cars by other than the railroads to which they belong. The gauge of track, that is the width between rails, up to the latter half of the last century was anything but uniform, it therefore often being impossible for a car of one railroad to run on the track of another road. The adoption of the standard gauge of four feet, eight and a half inches made it practicable for the cars of any railroad to run over the tracks of practically every other railroad in the United States, doing away with the necessity for transferring through shipments from one car to another. Cars of any one railroad are therefore likely to find their way all over the United States. At each junction point there is an inspector who examines the cars in transit from one road to the other, and when they are in need of repairs sends them to the shops of the road on which they happen to be; and that road renders bills for repairs upon a schedule formu-

lated by the Master Car Builders Association, to the road responsible for their impaired condition.

A charge is also made by the home road for its cars while on the rails of another road, generally on a basis of so much per day for the time the cars are on another road, the object being to make it to the interest of the foreign road to return cars promptly to the home road, and to enable the owner to receive just return for the use of its cars. This per diem charge has gradually advanced, and there is an additional charge as penalty for detention after thirty days. At all junction points throughout the United States it is the duty of the junction agent to fill in a postal card with the description of each car of any road that comes to his line, and that junction card is mailed to the car accountant, an officer usually subordinate to the general superintendent of transportation, of the road owning the car. The car accountant keeps record of the whereabouts of each car belonging to his own company, and of each car belonging to every other company during the time it is on his line. Each company reports to all other companies the numbers of the cars owned by them respectively, which have been in service on its lines during the month and the number of days of such service for each car. These reports are

verified by the car accountant of each company, and are the basis of settlement of the car service account, which is effected by the accounting department making drafts or authorizing the acceptance of drafts for balances.

Conductors, and especially those of passenger trains, who frequently receive money for passenger fares in lieu of tickets are also required to make reports of their receipts to the accounting department.

Toward ascertaining how much has been gained or lost by a railroad company during any given period, it follows that the total expenditure and the total revenue must be ascertained, together with the resulting balance. This is accomplished by the auditor of disbursements, the auditor of passenger revenue, and the auditor of freight revenue each transmitting monthly the totals of the general items which are audited in detail in their respective departments, to the general auditor in whose office are kept the general books.

That is, the auditor of disbursements each month transmits to the general auditor the totals of the expenditures for maintenance of way and structures, maintenance of equipment, conducting transportation, taxes, rentals, general and miscellaneous expenditures. The auditor of passenger

revenue transmits the totals of the receipts for tickets and passenger fares from agents and conductors; the total of the amounts due other companies because of their proportion of the receipts from the sale of through tickets; the total of the amounts due from other companies because of the sale of through tickets by them; and finally the totals of the net amounts accruing to the company from coupon tickets, from sales of local tickets, from cash collected by conductors; from excess baggage, storage of baggage and other sources allied with the passenger traffic. Likewise the auditor of freight revenue transmits the totals of the receipts from local freight; from through freight; and the payments on vouchers of the freight claim agent because of overcharges, loss and damage. The earnings from the carriage of mails are accredited each month with one twelfth of the sum specified as the annual compensation of the railroad from the Government; and the earnings from express companies are accredited with receipts from the express companies, under the terms specified in the contracts made therewith.

After proper adjustment and deductions the aggregate of the totals of the columns showing receipts indicates the gross earnings; the aggregate of the totals of the columns showing the expenditures

indicates the operating expenses; the difference is the net earnings, from which are deducted the taxes.

To the remainder is added "Income From Other Sources:" that is from rentals, securities and other sources which do not depend on the operation, the sum thus obtained being the "Total Income." From this are deducted the expenditures for interest and rentals, and the other items constituting what are known as the fixed charges. The remainder is the "Surplus Income" from which are paid dividends, appropriations for improvements, and betterments which are not capitalized, what is left being the balance carried to the credit of profit and loss: that is, the residual amount to be added to the surplus after all expenditures for every purpose.

From the general books a tabulation is made of this information, as exemplified by the following Income Account of The Southern Railway Company for the year ended June 30, 1905:

Gross Earnings from Operation .	$48,145,108.15
Operating Expenses and Taxes .	35,082,514.61
Net Earnings from Operation . .	13,062,593.54
Income from Other Sources . . .	1,612,840.44
Total Income	14,675,433.98
Interest and Rentals	9,290,433.41
Other Deductions from Income . .	233,368.57
Total Deductions	9,523,801.98

Surplus Income	5,151,632.00
Total Dividends	3,000,000.00
Special Appropriations	1,056,549.49
Balance to Credit of Profit & Loss	$1,095,082.51

When it is endeavored to make exact application to the operations of a railroad company, of that function of an accountant which consists in ascertaining how much is gained or lost by each incident of the operation, there is brought out clearly the fact that unlike nearly every other industry and nearly every other business, it cannot be ascertained exactly what is gained or lost by a railroad because of any one incident or any one phase of its operation. A department store knows what the cost has been of the goods for any one particular department and what has been the revenue derived from their sale: the inclusion of the wages of the employes in that department and the proper proportion of the general expense discloses what has been the profit or loss of that department for a given period. A coal company with a number of mines can tell with approximate exactness just what has been the expenditure at any particular mine, and the receipts from that mine. Even in a vast factory, where workmen are engaged in the same room on one piece of work after another, there can be ascertained under the modern shop

ticket system the expenditure account of each job, which can be directly placed against the receipts for that job. While there are general expenses of a department store, mine or factory that continue whether the amount of business be large or small, they are but a small fraction of the total expenditure which varies in close accordance with the variations in the volume of the business. But as we have previously ascertained, a very large proportion of the expenditure of a railroad company, indeed the major portion, continues without regard to the volume of business. Therefore the expenditures cannot be definitely apportioned between the constituent parts of the traffic: they cannot be allocated among particular trains or particular cars. Each account of a railroad company therefore is not, as are the most of the accounts of an industrial or commercial establishment, made up of debits and credits. There are expenditure accounts usually composed solely of debits, and revenue accounts usually composed solely of credits. This is another way of saying what we have previously ascertained, that the expenditures of a railroad must be regarded as a whole, and the revenue must be regarded as a whole.

The nearest approach that can be made to balancing a unit of expenditure against a unit of

revenue, is by a system of averages. The expenses of administration cannot be divided between the freight and passenger traffic except on an arbitrary basis: likewise with the expenditure for maintenance of way. The wages for train crews and fuel can be definitely apportioned between freight and passenger traffic, but the expenses for wages at stations cannot in all cases be so apportioned.

It is customary for an accounting department, by way of approximation, to apportion the general expenditures between the different kinds of traffic, in the proportion that the earnings of each part bear to the whole, or sometimes in the proportion of the respective train mileage. That is, leaving out of consideration other sources of revenue, if the freight revenue be two thirds, and the passenger revenue one third of the whole; or if the freight train mileage be two thirds, and the passenger train mileage one third of the whole, the otherwise unassignable expenditure can be apportioned in this ratio; and when to these apportionments are added the expenditures directly traceable to the passenger traffic and to the freight traffic, there is ascertained approximately the total expenditure for each. If the respective totals be divided by the total number of passengers carried one mile, or the total tons of freight carried one mile, there is

obtained the cost; that is an estimated cost of moving a passenger one mile and a ton of freight one mile.

While however the expenditure of a railroad company cannot be allocated with exactness among different portions of the traffic, it can be so distributed as to assign with the utmost exactness any item of expense to the specific incident of operation for which it has been incurred. That is, while a unit of expense cannot be balanced against a unit of revenue except through estimates and averages, every expenditure can be so analyzed that its different items may be assigned to the constituent incidents of construction, maintenance and operation. The proportion of labor applied to this task and that can be shown on the pay rolls, the quantity of material used for this purpose and that, reported and recorded with the price thereof by the accounting department. Therefore the accounting department can ascertain, for example, what has been the expenditure for renewals of ties for a certain time, and for a certain division; what has been the expenditure for oil and waste for locomotives for a certain time, for a certain division, and for a certain locomotive, or for each locomotive mile run; what has been the cost of repairs and renewals of shop

machinery and tools for a certain period, and a certain shop; what has been the cost of erection of a certain station; what has been the expense for clearing away wrecks, for a certain period, on any particular division.

The accounting department can also ascertain what have been the constituent items of any kind of traffic; for example, how many through passengers have passed over any particular portion of the road, or on any particular train, or through any particular junction point, and what amount of revenue has been derived in each case; or how many trains or carloads of live stock, dressed beef, cotton, wheat, coal, iron ore or household goods have been carried between this point and that, and what amount of revenue has been derived in each case.

It can also ascertain how many miles run per locomotive, how many miles run per passenger car or freight car have been required to move this traffic.

In preparing such information as this, information that is not immediately necessary to the counting and guarding of expenditures, and the counting and guarding of receipts, that is not immediately necessary to the compilation of the statements of profit and loss, the accounting department emerges from the purely bookkeeping

performance into a function of the highest benefit in railroad administration, which can be appreciated after a brief survey of a phase of the development of that administration.

The early railroads were rarely more than one or two hundred miles long. The officer responsible for maintenance and operation was personally familiar with every mile of the track, the characteristics of every locomotive, and of almost every employe on the pay roll. By continual travel over the road and incessant personal supervision this officer, the man immediately responsible to the owners of the road, could immediately direct the application of material and the performance of the employes. As many of the roads were extended and as there was amalgamation of the smaller roads, this minute direction of the one responsible officer passed beyond the limits of any one man's capacity. Certain measures of authority had to be delegated to others, the operations not often being so extensive as to baffle the personal inspection of the responsible manager. As however the larger railways have been extended over thousands of miles, and there has been amalgamation of large roads into systems, each penetrating many states, traversing both lowlands and mountains, with traffic increasing in density and variety, there

has arisen that complicated organization, the results of whose co-ordinated performance are absolutely beyond unaided physical perception. By way of exhibiting the results of the details of different phases of operation, of comparing the performance of one division with that of another, the accounting department began to collect and record figures, not simply with a view of making bookkeeping debits and credits, but with a view to aid in the scrutiny of any detail of performance, by placing in comparison the results obtained here with the results obtained there, the results obtained at one period with those obtained during another and corresponding period, thereby enabling analysis of the causes producing variations, the elimination of idiosyncrasies and inefficient practice, and the intelligent outline of a policy for the future. This practice has developed into a system of statistics which by universal consent has been a foremost factor in contributing to the efficiency of the American railroads.

Inasmuch as the essence of that analytical survey of the operations implied by a system of statistics is a comparison of performance at one time with like performance at another time, with the intent of detecting variations and ascertaining the reason therefore, it is evident that the units

of comparison must always be made up of like parts. That is, like expenditures for like purposes, like receipts from like sources, like measurements of like results must be similarily grouped. In other words, there must be an exact and well defined system of classification under which every item of record, whether trifling or great, find its exact disposition. The standard classification of expenditure accounts has been attained through the experiments and discussion of many years, which have crystallized through the American Association of Railway Accounting Officers in conjunction with the Statistician of the Interstate Commerce Commission as follows:

CLASSIFICATION OF OPERATING EXPENSES

MAINTENANCE OF WAY AND STRUCTURES

Repairs of Roadway
Renewals of Rails
Renewals of Ties
Repairs and Renewals of Bridges and Culverts
Repairs and Renewals of Fences, Road Crossings, Signs and Cattle Guards
Repairs and Renewals of Buildings and Fixtures
Repairs and Renewals of Docks and Wharves
Repairs and Renewals of Telegraph
Stationery and Printing
Other Expenses

MAINTENANCE OF EQUIPMENT

- Superintendence
- Repairs and Renewals of Locomotives
- Repairs and Renewals of Passenger Cars
- Repairs and Renewals of Freight Cars
- Repairs and Renewals of Work Cars
- Repairs and Renewals of Marine Equipment
- Repairs and Renewals of Shop Machinery
- Repairs and Renewals of Shop Machinery and Tools
- Stationery and Printing
- Other Expenses

CONDUCTING TRANSPORTATION

- Superintendence
- Engine and Roundhouse Men
- Fuel for Locomotives
- Water Supply for Locomotives
- Oil, Tallow and Waste for Locomotives
- Other Supplies for Locomotives
- Train Service
- Train Supplies and Expenses
- Switchmen, Flagmen and Watchmen
- Telegraph Expenses
- Station Service
- Station Supplies
- Switching Charges-Balance
- Car Mileage-Balance
- Hire of Equipment-Balance
- Loss and Damage
- Injuries to Persons
- Clearing Wrecks
- Operating Marine Equipment
- Advertising
- Outside Agencies
- Commissions
- Stock Yards and Elevators

Rents for Tracks, Yards and Terminals
Rents for Buildings and Other Property
Stationery and Printing
Other Expenses

General Expenses

Salaries of General Officers
Salaries of Clerks and Attendants
General Office Expenses and Supplies
Insurance
Law Expenses
Stationery and Printing
Other Expenses

Each of the above headings is divided and sub-divided, each road following its own practice, so that in the ultimate analysis each expenditure may be traced to the last detail.

The expenditures for each particular item of this classification are tabulated for each month and for a period of months, division by division; in parallel columns are the expenditures for the same purpose, division by division, for the month, the previous month and for the corresponding month and period of months for the previous year, and the percentages of decrease or increase are shown for each comparison. Any unusual variation from the normal is thereby quickly detected, is made the subject of inquiry, and a corrective applied in case erroneous practice is disclosed. As an example of what can be accomplished by scru-

tiny of such detail is the discovery, made by an executive officer,—who not long ago came to the chairmanship of a prominent railroad system,—through analysis and comparison of expenditures and assets, that three million dollars worth of material and supplies more than were necessary had been purchased and were going to waste in the storehouses and along the tracks.

There is not only classification of expenditures but of the revenue, in addition to which statements are made showing the comparative movements for different periods of particular kinds of traffic, both passenger and freight, from given starting points to given destinations.

As it is in the last analysis upon the movement of rolling stock, upon the performance of locomotives and cars that the efficiency of operation depends, the application of the statistical system to the movement is many sided, in order that there may be comparison and analysis from many standpoints, that the different phases of operation may each be measured by many units.

As the locomotive is the source of motive power a careful comparative report is kept of the engine mileage, of the average miles per engine, of the coal consumed per engine, per mile, per one thousand ton miles of the cost of oil and waste, of the wages

per engine mile of engineers, firemen and roundhouse men. These various motive power expenditures are applied to the gross tonnage, and comparison is made of the resulting tons handled per freight train mile, per freight car mile.

As the amount of freight revenue is largely dependent upon the greatest possible movement of freight cars, loaded as nearly as possible to their capacity, a careful record is kept of car performance, showing the mileage of loaded freight cars, the mileage of empty freight cars, the number of cars per train, the average number of tons per car, per train, per train mile. Reports showing the average mileage per car per day, the number of days that each car is under load and is empty, that it is in motion, that it is standing in yards or on sidetracks are carefully scrutinized, and especial attention is given to the movement of cars that have been over long at any one place.

Statistics are also gathered as to the durability of rails of different kinds, and different materials under different conditions; of the life of ties of different woods under different conditions; of the performance of different machines and different appliances of all kinds.

A fairly adequate understanding of the appli-

cation of the system of statistics of the American railroads, which has here been but roughly outlined, can be gained by an examination of the annual report of any of the principal companies. ´Here and there is still a railroad manager of the old school, or inadequate technical training, who is apt to decry the use of statistics as leading to a theoretical and paper administration, and it is quite true at the other extreme that statistics are here and there so misapplied, so abused that an officer buries himself in a mass of figures instead of running his road. Statistics are never more than an aid to the judgment. The result of the intelligent use of them in the United States needs no more striking testimonial than that of Mr. Neville Priestly, the Under Secretary of India, who was appointed by his government three or four years ago to make an investigation of the methods of the American railroads. In his report, the excellence of which was quickly recognized and which has become a work of standard reference, Mr. Priestly said:

"One of the subjects which had exercised my mind a good deal before I went to America was how the large undertakings now operated under one organization were managed and controlled, since personal supervision by the higher officers

was no longer practicable. I asked the question of several presidents, vice-presidents, heads of departments and district officers whom I met. Without exception they gave me the answer that the control was exercised through statistics. Equally without exception they said they could not possibly conduct their business efficiently without statistics; that without them they were working in the dark; and that they could not understand how any railroad could be efficiently and economically operated without statistics. The president of the railroad which has made the most scientific study of the subject told me that at one time his railway kept only the most meagre statistics. Beyond knowing in a general way that he ran so many train miles and carried so many passengers and so many tons of goods and that he earned so much revenue and expended so much money in the service, he had no information. He had no means of knowing what the income from any particular service was, nor had he then any idea of the cost of providing it. He had no standards of any kind to guide him. He felt this was not right and that if he was to operate his railway economically and with profit he must know exactly where the money went, and what income was being received for a particular expenditure. He accordingly proceeded

to devise some form of statistics which would give him the necessary information and, after many trials and errors, he arrived at his present system. . . . I was assured that both he and his officers were quite satisfied that the money was more than well spent, and that by means of these statistics they had been enabled to introduce reforms and economies, the necessity for which would otherwise never have been known, and that generally the outlay which they incurred in the compilation of the statistics represented only a very small percentage of the saving effected by their aid. . . . Of course every one recognizes that experience and reflection are necessary for the intelligent application of all statistics and that statistics used without intelligence may be not only of no value, but very harmful. But it is contended that, when used with intelligence, they help to impress all with the money value of the service performed and to bring sharply to their attention the cost of inefficient service, helping thereby to cut out a proportion of the numerous things that militate against an economical performance."

The compilation and working up of the statistical data is sometimes in charge of a separate bureau, or even a separate department under the direction of the Statistician, who may report

directly to an executive officer, but more frequently the Statistician and his work are co-ordinated with the other work of the accounting department, under the direction of the ranking accounting officer who is usually entitled the Comptroller.

The accounting department has a larger force of employes than any other department of the general administration. In the assorting of tickets and waybills, checking the rates with tariffs, scrutinizing vouchers and verifying all calculations are engaged platoons of clerks: the supervising clerk of each detachment co-ordinates the data verified by his subordinates into the form that through successive generalization, is finally transmitted by the department auditors as the basis of entries on the books. The making of statements and tabulations of various kinds enlists the efforts of scores of men skilled in analysis and comparison.

It being the province of the accounting department to verify, record and place in due relation every item both of expenditure and of revenue that arises from any phase of the company's status or activity, it follows that this department is the storehouse of that information upon which must be predicated every modification of the road, its equipment and conduct, every variation in procedure, every change in policy.

V

FINANCIAL AND EXECUTIVE ADMINISTRATION

That possession and use which are implied by the word property, attained something like definiteness when in the course of the ages, the living organism came to walk on two feet, and learned to use the club and the flint. With the wars between savage tribes there came the enslavement of the conquered, that property in persons whereunder the captors benefited by the results of the efforts under duress, of the captured. As industry and commerce progressed, as the keenness to see and the capacity to make use of opportunities for pecuniary gain developed in different degree in different men, there came the system of wage, whereby those who work under the direction of others barter property in the results of their efforts, for property in the wage paid by their employers.

The stimulus that commerce received in the fifteenth century led to the subscription of capital from many sources for the conduct of the large enterprise, to joint ownership, evidenced by the

stock certificate. Thus was differentiated ownership from administration; thus arose the mechanism through which profit may be obtained from the efforts of others who are directed by an intermediary; that is, the organization for the pursuit of industry or commerce took on the threefold aspect of the owner, the manager and the employe, which has been accentuated by the conspicuous coalitions of the past decade.

Were it not for the device of the joint stock company, railroad building in the United States would not have proceeded so rapidly. It enabled contributions from the rich, and the thrifty, and from bodies politic, to be joined in an aggregate, far greater than could be obtained from any one source, to be devoted to the building and equipping of the new means of transportation. When the stock subscription books of the Baltimore and Ohio Railroad were opened in 1827, there were subscriptions from citizens to thousands of shares, and contributions from the City of Baltimore and the State of Maryland. The motive was not directly of profit: it was to provide means of transportation from and to the West and the South, that would restore and maintain the commercial importance of Baltimore. For similar reasons other railroads were built, for the benefit of particular

cities or particular states or to unite different sections of the country. Pecuniary profit from the operation was not a prime consideration; capital subscriptions were made in the absence of data upon which return could be predicated.

The lack of experience and the consequent ignorance of what was really required for the construction and equipment of a railroad, together with the necessity for rebuilding, that as in the case of the Baltimore and Ohio was nearly always coincident with completion, and that infirmity of the human mind whereby estimate is nearly always vastly less than expenditure, usually caused capital subscriptions to be inadequate to the purpose. When additional subscriptions to the joint stock capital could not be obtained, there was recourse to a variety of expedients, the commonest and the simplest being the borrowing of money. The security for borrowed money is the railroad, its franchises, right of way, roadbed, equipment and structures. The loan is certified by a bond, a document which binds the borrower to return the loan and to pay interest for the use thereof: the pledge of the security is certified by a mortgage, describing the property which the borrower shall forfeit to the bondholders if the loan is not repaid, or interest paid under the specified terms.

Just as the ownership of the property is divided among many, and attested by stock certificates, so is a loan usually divided among many whose fractional participation in the total of the bond is evidenced by certificates, each of which for convenience and by usage is entitled a bond.

A stockholder participates in the ownership of a railroad, and therefore in the profits: a bondholder participates in the loan, and therefore in the interest. Profits are limited by commercial conditions: interest is limited by the money market. A stockholder may receive returns that may be more or less, or he may receive no return at all: the bondholders receive their fixed interest, or in default of that come into possession of the road. That is, the stockholder takes risk; the bondholder does not, except as he may err in his judgment that the value of the property pledged is good for the amount of the bond.

The reckless exuberance that has characterized the activity of this country, together with the besetting credulity of the human race, has often made it an easy matter for the over sanguine promoter and the speculative shark to obtain subscriptions to stock and participations in bonds regardless of any sound basis for investment. The panics of 1857, of 1873 and of 1893 threw large

portions of the railroad mileage of the country into bankruptcy. In some cases stockholders completely lost their investment, and sometimes there was not enough of value to redeem the bonds. Reorganization followed reorganization, original investments being so lost to sight as to often bear little or no relation to the new capitalization. These financial storms and struggles which the railroads were first of the large corporations to pass through, gradually brought experience, judgment and the precaution. Hence have come the financial adjustments of the railroads of the United States, that in the later years have made their standard and established securities second in stability and desirability only to the sound issues of the various governments.

When we speak of ownership in or of a mortgage on a railroad, it must be understood that in an essential respect property in a railroad—and in a few related enterprises—is different from property in any other possession of mankind. If you borrow money, pledging personal property of whatever nature as security, and do not pay the loan, your chattels given as security will be taken away. If a mortgage is foreclosed on your house, the mortgagee may occupy it, or he may rent or sell it, or destroy it and erect a new structure in its

place. If a storehouse, warehouse or factory is surrendered it may, if it were the unprofitable nature of the business that led to the foreclosure, be utilized for some other business, or the machinery or the other contents may be removed to another place, building torn down and the real estate devoted to some other purpose. If a farm is surrendered to a mortgagee he may use it for pasture, raise grain, turn it into a truck farm, or perhaps divide it into town lots. But if a railroad be surrendered to the bondholders they can do nothing with it but run it as a railroad. If they should desire to abandon it altogether, probably not enough could be obtained for the right of way as real estate to pay for tearing up the track and leveling the embankment; the rail and equipment could doubtless be disposed of, but not for nearly their cost; the buildings are of little or no value except as they pertain to the railroad. And the railroad cannot be moved to another place: it must be operated as a railroad between the places and through the territory where it was constructed. No difference in what manner or by whom it is operated, there must be payments for wages and for material; there must be expenditures for maintenance of way, maintenance of equipment, conducting transportation, taxes and general

expenses; revenue must be derived from the sale of transportation; nor can bondholders or stockholders receive any return except from the margin by which revenue from all sources exceeds expenditure for all purposes.

Therefore, it is plain that the investment of a bondholder or a stockholder in a railroad is not in reality in the corporate rights and the material structures of the railroad, except to the extent that these rights and structures are factors in operating it. As it is from the margin of revenue over expenditures, that is from the earning power of the railroad, that stockholders or bondholders can obtain return, ownership in the road, or in a mortgage upon the road are in reality different bases for participation in the earnings.

The mortgagees, that is the bondholders, having as a last recourse the right to take a railroad and operate it themselves, receive on their bonds a specified rate of interest, that is fixed and determined by the rate at which money can be borrowed. The stockholders, who have everything to gain and everything to lose by the operation of the railroad—who, if the margin of revenue above expenses is not sufficient, after payment of interest to the bondholders, to yield a return on their

stock, derive no profit from their holdings of that stock—are responsible for its operation. The right to the possession of the profits means ownership, which means the right to direct the operations which produce the profits.

Responsibility for the operation implies responsibility for the administration, which necessitates the selection of those charged with the administration. This is accomplished by the election at an annual meeting of the stockholders, of a board of directors who elect a president, a secretary, and a treasurer, and usually one or more vice-presidents. The president is the principal executive officer, the intermediary between the administrative organization and the board of directors. The secretary records the proceedings of the board of directors, attests the contracts and keeps the archives of the company.

The treasurer is the officer immediately responsible for the receipt and payment of moneys. The moneys received by an agent of the company at a place where there is not a bank of deposit are forwarded directly by express to a depository, or to the treasurer by whom they are deposited in a bank; moneys received by an agent where there is a bank, are deposited by him, and a duplicate of the deposit slip

is forwarded by the bank to the treasurer. In either event and in every instance of the receipt of money, the accounting department is advised of the amount, and of the agent or other source to be credited. The treasurer transfers the deposits from one bank to another, and conserves the funds on hand as may be necessary to meet the demands of the company. Through cashiers and paymasters he pays the vouchers and pay-rolls, after they are verified and recorded by the accounting department, taking proper receipts. The treasurer watches the standing of the various banks that are the depositories of his company, and makes periodical reports to the president and directors of the funds on hand. Some of the larger railroad companies have a vice-president in charge of finance, whose especial duty it is to keep at all times informed as to the ebb and flow of the money market, of the financial conditions in this and other countries, that his company may obtain money when necessary on the best terms, may receive the highest rate of interest for funds which it is conserving; that its financial condition at all times may be kept in the most advantageous equilibrium.

In the vast majority of questions arising in the administration of a railroad, the president is

the court of last resort; his decision is final. Matters of such importance as to fundamentally affect the status of the property are referred by him to and discussed and determined by the board of directors or by an executive committee, the members of which are chosen from the board of directors; and the proceedings of the executive committee are reported to the board of directors for approval. The matter of rates never comes before the board of directors except in a general way and in broad relations. Under no circumstances does the board attempt to fix a specific rate for a specific service.

It is a prime duty of this body, which at the decree of the stockholders is responsible for the preservation as well as the administration of the property, to see that the company's books correctly reflect the value of its assets; to so order its revenue as to maintain financial stability, to see that its facilities are increased and extended as the interest of the company may require; and to arrange for the approval of the stockholders, plans for provision of funds necessary for expenditure on capital account.

Locomotives, cars, buildings and track all deteriorate, whether from wear or disuse. If allowance for destruction or deterioration is not made

on the books of the company, there comes a time when the assets as shown on the books are vastly in excess of the value of the assets as they exist; the property represented by the stock certificates and pledged to the bondholders has waned. This it will be remembered was a prime factor in the causes that led to the disaster which overtook the Baltimore and Ohio Railroad Company. A board of directors is not considered to perform its duty to-day, unless it sees that the depreciation of the property from year to year is clearly indicated, or else that the repairs and renewals that are made out of the revenue are sufficient to maintain the assets unimpaired. It therefore is necessary that there be decision as to whether expenditures for buildings, equipment, track or other facilities be charged to a replacement account or to a capital account: that is, whether the expenditure be to maintain the earning power of the company, or to increase the earning power. To this end and to protect the disposition of net earnings, while the general manager or the vice-president in charge of operation usually is permitted to authorize expenditures within a limited amount, any considerable expenditure is presented by the president to the board of directors for authorization and for decision as to what account it is to be charged, the recom-

mendation of the president in this as in other respects nearly always being accepted.

In the conservation of the financial status of the company, it is necessary that the board of directors decide what disposition be made of that margin by which the income exceeds the outgo. It declares the rate of dividend and what amount shall be placed in the surplus. It is at this day the endeavor of every board of directors desiring the continuance in stability of its company's finances, to build up a surplus fund that will enable the company to successfully weather a period of commercial depression or a panic. To this end companies that have not attained an assured basis, often allow the stockholders to do without dividends that the surplus may be upbuilt.

Propositions to extend the company's lines or in other ways to radically increase its facilities, whether by new construction, purchase, lease or other method of acquisition, are passed upon by the board of directors, and when necessary submitted to a vote of the stockholders.

When it is necessary that funds be obtained for capital requirements, that is for the provision of facilities that will increase the earning power of the company, the board of directors formulate a plan for submission to and ratification by the stockholders.

When a company whose management is of established efficiency, whose capacity to pay dividends on its outstanding stock has met the test of years, desires to radically extend its tracks or its facilities, it has in times of ordinary prosperity no difficulty in selling new capital stock. This in some cases may be simply an addition to outstanding issues, all issues participating alike in the profits of the facilities existing and of those to be acquired; or the new stock may be considered a separate issue, giving participation only in the profits of the new facilities for the provision of which it is subscribed.

The element of risk however, that in greater or less degree attends all new enterprises, often leads the investor to desire that degree of security which is afforded by a bond. If at the time of a bond issue a company have no bonds outstanding, the preparation of the mortgage is a simple matter, as the specification of the security would be a list of the assets of the company. With but few exceptions however every existing railroad company is responsible for several bond issues. Every extensive railroad system has been formed of many smaller roads, each of which at the time of its amalgamation might have had bonds constituting a prior lien upon the property by which they are secured.

Sometimes these issues continue as a separate lien but in other cases the new company may issue a mortgage covering the combined property of the amalgamated roads, the bonds secured by which are exchanged for the bonds secured by the previous mortgages. The new or consolidated mortgage as it is often termed becomes a prior lien upon the entire property when the previous bonds have been retired. In addition to such a consolidated mortgage, a road may have other mortgages securing other bond issues, which may be a junior lien upon all of the property, or a prior lien upon parts of the property, or a prior lien upon certain parts of the property and a junior lien upon other parts.

If an investment has evident elements of hazard or when money for investment is not plentiful, shares of stock are sometimes offered gratis as an inducement to elicit bond subscriptions, one share or two shares of stock, for example, being given with each bond purchased, the subscriber thereby obtaining an opportunity to participate in future profits in addition to obtaining the interest accruing on the bonds. It goes without saying that without other inducement, an investor would not take the bonds of a new enterprise paying no greater interest than securities that have stood the test of years.

Stock may be preferred or common, the issue of the former being of a limited amount upon which dividends may not exceed a certain specified percentage, the latter participating in whatever profits may remain after the interest on bonds and dividends on preferred stock have been paid.

There also has been issued by some railroad companies what is designated an income bond: it is not secured by a mortgage, but the interest has to be paid before dividends can be paid on any kind of stock. As moreover, an income bond often carries the right to vote at meetings of stockholders, it is in reality a preferred stock underlying other issues of preferred stock.

When a railroad company desires to obtain new capital funds, it may offer a new issue of stock or of bonds to its stockholders for their subscription or with their consent directly to the public. As a rule however, after the issue has been authorized by the stockholders, the company through its president or its financial officers first consults one or more firms of bankers, who have knowledge as to accumulated funds awaiting investment, and of the terms that will be acceptable to investors. Such bankers of experience and ability are also relied upon in large measure by trust companies, savings banks, and other custodians of investment funds

to recommend securities for investment. The opinion of such bankers is usually accepted as to the amount of funds that can be secured at any given time, and as to the manner in which an offering shall be made, whether of stock or bonds. If the latter their advice is sought as to the duration of the bonds, and the rate of interest to be paid upon them. Sometimes the desire of investors is for bonds to run a long time in order that they may have a secure investment for a period of years, at others it is for bonds running a short time, thus returning their funds for other investment. As a rule the longer the duration of the bonds the lower is the rate of interest. Two or three years ago the taste of the market was for what were styled short term collateral notes, running but a few years at a high rate of interest. The security for such notes is not a mortgage of the property of the issuing company, but bonds and stocks owned by it. Such securities are held by many of the companies of to-day in large amounts. They may have been acquired by the purchase of stock or bonds of companies leased to or operated by it, or the control of which has been desirable, or they may have been purchased so as to acquire an interest in, or control of, terminal, elevator, bridge, ferry or other companies

allied with or necessary for railroad transportation.

A mortgage securing an issue of bonds is usually made by a railroad company to a trust company of prominent financial standing, which thereby becomes a trustee, whose duty it is to see that the mortgage is properly executed and recorded; to certify all the bonds that are issued thereunder, to see that no more bonds are issued thereunder than the aggregate amount provided for in the mortgage; and, in the event of failure to pay the interest upon the bonds or in the case of foreclosure, to act as trustee for the bondholders.

Stock is issued by a company to the persons who have subscribed therefor, by means of stock certificates for the number of shares subscribed. Each certificate is signed by the proper officers and sealed with the corporate seal of the company. Every company is by law obliged to maintain a transfer office, usually at its principal office in the state in which it is incorporated, and sometimes at other prominent financial centres like the City of New York, in which persons holding its shares may transfer them to others. These transfers are made in the presence of an officer of the company by the execution of an assignment which is usually printed on the the back of the certificate. It is customary to

appoint a trust company to register the new stock certificates, and in the performance of this duty it first cancels the old or transferred certificates, and then register or certifies the new. The end and aim of its duties as such registrar is to insure that no more than the total number of duly authorized shares of stock are outstanding at one time.

Payments of dividends on stock and interest on bonds are usually made by the company which has issued such stocks and bonds, by check directly to the stock and bondholders as they are listed on its books. When, however, the general office of the company is located some distance from a financial centre, such payments are, for the convenience of the holders, made by the issuing company, in total amounts due at given times, to a trust company which makes payments to the individual stock and bondholders. This latter course is generally followed in the case of coupon bonds, which require that coupons must be clipped from the bonds and delivered to the trust company in person or by mail.

Shares of stock and bonds are bought and sold as are other things in which there is property or value. These sales are usually effected through stock exchanges by stock brokers, each of whom

must hold membership in the exchange. As a rule, to which however, even in the New York Stock Exchange there are many exceptions, he deals on the exchange only in such stocks and bonds as are listed by it, that is as have passed the scrutiny of a committee appointed to determine upon the authenticity and reliability of the various issues which are offered to be traded in on the exchange.

That which leads to the investment of money is the desire to obtain money in return. That which determines the value of a share of a railroad stock, or a railroad bond, is therefore the ratio which the rate of dividends or the rate of interest bears to its cost; the regularity and permanence of the dividend, and the degree of security of the principal being factors of the first importance. Many issues of stock represent the hazard in an enterprise and depend entirely for any value they may have upon the possibilities of the future. It follows that the only market value possessed by such issues arises from the opinion of would-be purchasers that the development of the traffic and consequent increase in the earnings of the corporation, will at some future time result in the payment of dividends. A bond is not always originally sold for the amount specified on its face. An element of hazard in the security, or the mutual convenience

of the issuing company and the investor, sometimes find expression in the sale at a certain discount, although the interest be paid on the face value, the return of which in due time is called for by the mortgage. Those who buy and sell stocks and bonds intelligently, therefore scrutinize the characteristics of each issue, the progress of the issuing company, the efficiency of its administration, the character of and fluctuation in its traffic, and likewise the ebb and flow of the various economic and political conditions that have effect ramifying throughout industry and commerce in general.

The status of a company is disclosed by the announcements, which in the case of the larger companies are usually made month by month and published in the financial papers, of its earnings and expenses; but more particularly in the report which is made annually by the president and board of directors to the stockholders, and ordinarily printed for distribution gratis to any one interested. The close scrutiny from every standpoint that is now given to corporate action makes it desirable for every railroad company to embody in this document sufficient of detail to make a reasonably complete exhibit of the company's status, and of the results of its operations for the year which it covers.

The annual report includes:

I—The Income Account, a statement of revenue and expenditures;

II—The Balance Sheet, an exhibit of the financial status;

III—A Statement of the physical condition of the road and of the statistics of operation.

From the Income Account, which should show in detail the proportions of the total revenue derived from each source, and the proportions of the total expenditure incurred for each purpose, can be ascertained in what direction the revenue and the expenditure have increased or decreased as compared with previous years. Therefrom, in connection with the general factors affecting the result, can be obtained a fairly accurate guide to the efficiency of the general administration.

From the balance sheet, which contains a statement of the company's assets and liabilities, can be ascertained what disposition has been made of the company's net income, what are the amounts due to its debtors and from its creditors. A comparison of the balance sheet for any year with that of previous years, and a scrutiny of the variations, will afford an approximate check upon the

soundness of the conduct of a company's finances.

The statement of the physical condition of the road will show the mileage and equipment in comparison with that of the previous year, and the statistics—which should specify the train and engine mileage; the number of passengers, of passengers one mile, and per train mile; the tons of freight, tons one mile, tons per train mile, the average earnings per train mile, per passenger mile, per ton mile, in comparison with the average expenses per train mile, per passenger mile and per ton mile—will compared with similar statistics for previous years, and with similar statistics of other similarly conditioned companies for the same year, disclose with reasonable accuracy the efficiency of the operations.

When the affairs of a railroad company become lacking in prosperity, that condition is apparent to a close scrutiny of the annual report, even although the directors are not willing to admit it. Under the double entry system of bookkeeping a debit must be balanced by a credit, an entry under assets by an entry under liabilities; a covering up on one side of the ledger means an entry vulnerable to exposure on the other, and income and outgo can be traced through the statistics of operation. The value of the stock and securities of a

company may be affected in the stock market by such disclosures in the annual report; or, as frequently happens, the monthly statements of earnings, and other indications patent to the observer, show that the company's affairs are not propitious, and a depression in the prices of its stock and securities follows. In case the worst arrives, so that dividends are not only passed on stock, but interest cannot be paid on the bonds and other funded indebtedness, the road is bankrupt.

The ordinary course of procedure when a business concern becomes bankrupt, is for one or more of the creditors to obtain judgment, have it placed in the hands of the sheriff and sold at auction. As prices obtained at a forced sale are usually far lower than can be secured if the property is conserved and disposed of under more favorable conditions, the plan was devised of appointing a conservator, or receiver, to take charge of the property on behalf of the court during the period of its dissolution.

As we have ascertained, however, the foreclosure of a railroad does not mean that the track, structures or equipment are deported or dismembered; the trains are obliged to run, the railroad is obliged to continue in business. It is the duty therefore of the receiver of a railroad company to maintain

it in operation. He must pay wages, buy supplies and collect revenue; that is, he must see that the performance of the functions of the railroad is continued without interruption. If the period of the receivership is protracted, there must be renewals of track, structures and equipment and the receiver must be empowered to make the necessary payments therefor. This is arranged by the issue, under the authority of the court whose agent the receiver is, of receiver's certificates which become a lien upon the property, underlying even a first mortgage. The resuscitation of the Baltimore and Ohio Railroad Company from its prostration of ten years ago, began with the authorization by the court of receiver's certificates to the amount of millions of dollars, to carry out the plans formed by the receivers, not only for the protection but for the development of the property.

The duration of a receivership depends upon the period necessary for the preparation and perfecting of a plan for reorganization that is acceptable to the controlling majority of the several interests involved. The preparation of such a plan usually devolves upon a committee selected by the different creditors. It is the first duty of this committee to ascertain the exact liabilities and exact assets of the company; to estimate what the earn-

ing power is likely to be after reorganization. Cash must be obtained to pay off debts and restore the efficiency of the property; arrangements must be made to provide cash for current use and future requirements. Finally there must be determined what proportion of the net earnings after reorganization may be applied to the payment of return on shares or securities. Then there must be determined, with great deliberation and recognition of the many and diverse factors that always enter into the situation, just what issues of stocks and bonds shall be made, in what manner and in what proportion they shall be distributed among the holders of the shares and securities at the time of bankruptcy. That is, it must be determined in what manner the loss occasioned by the bankruptcy will be divided among the share and security holders, what assessments there shall be, if any, and what shall be the proportions in which there shall be participation in the net income after reorganization. When there are bondholders under various mortgages, and holders of different kinds of stock, the preparation of an all round satisfactory plan of reorganization is not easy, and often results in litigation that may be protracted.

That rhythm which pervades all things finds

no more impressive exemplification in its application tion to human affairs than in the ebb and flow of prosperity. During the past six years the essential material progress of the people of the United States and their institutions has been almost unchecked. For six years preceding this era, up to within a year or so of its commencement, that is within less than ten years ago the industries and commerce of the United States were in a condition of great depression. Mills and mines were running but a fraction of the time; thousands of men in every part of the country were out of employment; it was the cry in the public press, from the platform, and in the conversation of the day that the capacity for production had outstripped any possible consumption for years to come, that the country had entered upon a prolonged era of stagnation. This condition and this apprehension had their effect upon the railroads, whose traffic fell off until thousands of cars stood empty on side tracks, hundreds of locomotives were dead in roundhouses; in 1894-5 over thirty-three per cent. of the railroad mileage of the United States was in the hands of receivers. The problem was to obtain funds to continue the railroads in operation; the man who at that time would have ventured to say that they would soon be actively

engaged in doubling and quadrupling their tracks and equipment would have been considered lacking in sanity. Yet, within four years from the period of deepest depression there was not half enough track, there were not half enough locomotives, nor half enough cars to move the traffic that poured upon the railroads from farms blessed with record crops, from mines and mills stimulated to a productivity theretofore unknown. Instead of being prepared for the stress the railroads were obliged to begin the extension of their facilities under the very intensity of the stress itself. That in many parts of the United States they have barely caught up with the demand is evident, and yet they are confronted with the necessity for the further increase of facilities, that they may be enabled to move the volume of traffic that steadily increases.

To this end it has been necessary for the railroad companies to secure since the beginning of this era of prosperity vast additions to their capital funds. During the past few years issues of stock and issues of bonds have been announced that have aggregated hundreds of millions of dollars, giving rise at different times to apprehension in different quarters. A survey of the traffic conditions of the United States, however, a conservative estimate on the basis of the past of what may

be expected in the future, makes the assertion entirely safe that the railroad companies as a whole, up to the time of this writing, instead of asking too much have sought too little of new capital. That this is the conservative sentiment of the country is shown by the fact that as a rule, the new capital issues have been readily absorbed by investors, the only exceptions being negligible in number, where promoters have sought to impose upon the credulity that in connection with railroad investment at least is no longer rampant.

It is to be remembered that the ratio of profits from railway operation is never large, that except in rare periods and under rare conditions, radical improvements and radical extensions cannot be paid for out of the earnings. If a railroad company continue to meet its expenses, its fixed charges, to pay dividends and to build up a moderate surplus, that is, if a railroad company keep moderately and continually ahead of its capital requirements, it is doing all that can be expected of it.

VI

CORRELATION

That throughout the administration of a railroad there must be a high degree of co-ordination between the different departments and the different officers and employes, that there must be a thoroughly defined and well understood method; and the utmost care and precaution in its application is a general statement. How well it is founded is exemplified by the routine procedure in what, although the most important, is but one phase of operation, the running of trains. Let us trace this procedure through a bit of actual working.

It is half past five on a Monday morning. Word has just come to the yardmaster from the train despatcher, to start a third section of train No. 82 at six thirty a. m. In the stalls at the roundhouse are four locomotives of Class A, three of Class B and five of Class C, all clean and fit, with the fires banked in the furnaces and a simmer of steam arising from the escape valves. The requisition from the yardmaster specifies an engine of Class B: No. 312 has been longest in; she brought

in fast freight 31 the evening before. On the work sheet the engineer marked her in good order throughout; noted that she needed no repairs, nothing but the regular cleaning; her exhaust was clean, her reciprocating parts were in adjustment, her bearings running cool. The hostler had taken her over the cinder pit, cleaned out the fire box and every part from the netting in the smoke-stack to the air pump. After the wipers had rubbed every square inch; after she had been cleaned inside and out with care, more than which no mother could give a child, a mechanical inspector went over her again from head-light to rear coupling, testing every passage way, sounding every fastening, checking every item of the report made by the engineer, and finding it true. And this is the standard practice with every engine between its going and coming in every roundhouse in the United States. Thus it was that at half-past five on a Monday morning, in response to the request of the yardmaster, the roundhouse foreman designated No. 312 as the locomotive of Class B to take out third No. 82.

A caller was sent for the engineman and the fireman whose names were posted "first out"—by customary practice every member of every engine crew lives within one mile of the roundhouse, is

expected to be at home during his period of rest and to appear at the roundhouse after call within thirty minutes of the prescribed train leaving time. And so it was that at six o'clock the fire had been unbanked in the furnace of No. 312 by the hostlers at the roundhouse, her tanks had been filled with water, her tender with coal, and her sand-box to the brim with the grains that give the wheels their grip on the slippery tracks of the upgrade. The engineer, with the familiar can, "oils round," examining for himself, every vital part of the machine. Then at twenty-five minutes after six, the hostler having delivered her beyond the cinder pit, the fireman dashed a shovelful of coal into the fire-box, the engineman gently placed his hand upon the throttle and as gently the ponderous mechanism began to move. The man in the signal tower at the entrance to the yard has thrown a switch, the head brakeman gives the "go ahead" signal, and No. 312 moves down and backs on track No. 5, stopping at the head of the waiting train.

At five o'clock that Monday morning the chief despatcher perceived from the reports of cars received and in the yard that there was a full quota of cars not only for regular No. 82 and a second section of No. 82, but that there remained nine

cars of lumber awaiting shipment to the east; that six cars of cotton were ready to go to the junction mills, and that other carloads of material and merchandise in "bunches" of threes and fours were destined east, enough in all to make a third train of thirty full loaded cars, about one-half of which were consigned to two or three stations along the division, and the other half to points beyond. Therefore, he directed the yardmaster to start a third section of No. 82, designating 6:30 as the leaving time. The gross weight of these thirty loaded cars amounted to approximately one thousand tons. A Class B locomotive, by the practice of this road, is so designated because it is rated to pull from one thousand to fifteen hundred tons; hence an engine of this class was requested for this train.

The yardmaster gave the numbers of the cars to the switching foreman, who made them up for the outgoing train; the cars for the first destination nearest the locomotive and so on, that they might be set off with the least switching. The cars were drilled from off this track and that into the prescribed order, and a trifle before half-past five the switching foreman reported to the yardmaster that the train was ready.

The car inspectors test wheels, brakes, axles,

journals, bearings on every car, connect the air-brake pipes, and test the application of the brakes.

At the same time that the yardmaster made requisition on the roundhouse for a locomotive he sent the yard caller to summon conductor, brakemen and flagman to man the train, and this crew reported at the yard office at the same time the engine crew reported at the roundhouse. The conductor was notified that his train was made up and on track No. 5; he and his flagman went to this track to "get numbers" of the cars and seals and to inspect the train, while the head brakeman went to the cinder pits to pilot engine No. 312 to the front of the train.

The conductor enters in his train-book the number of each car and the initials of the road owning it, its destination, its empty or tare weight; the weight of its load, and the sum of these or its gross weight. With the aid of the brakeman he carefully tests the seal that the loading agent has placed on each car and certifies to its soundness by entry in the trainbook—if the seal were not taut he would not accept the car until its contents had been checked and the seal placed in order. He again reports to the yard office, and with the yard clerk checks the car numbers that are recorded by the clerk as being forwarded,

with the cars of the numbers that he has entered in the train book, and receives from the yard clerk the bills for all cars in the train.

The conductor then confers with the engineman, who has coupled the locomotive to the train, and tested the working of the air brake pipes throughout. They are each ready, and so notify the yard operator who telegraphs the train despatcher that 3-S2—giving the number of the locomotive, the number of cars, the gross weight of the train, the name of the engineman, and the conductor—is in the yard awaiting instructions. The train despatcher enters this detail of the train and crew at the head of a column of the train register which is spread in front of him and on which is a space for the entry of the arriving and the leaving time of the train as telegraphed him by the operator at each telegraph station on the division.

After this initial entry, which is the work of but a moment, the train despatcher telegraphs a clearance order to the yard operator, who repeats it to the despatcher to ensure that he has made no error in receiving it. Then the yard operator presents the order to the engineer and conductor, who read it back to him, and sign it as acknowledgement that it is thoroughly understood.

These signatures are reported to the train despatcher, who telegraphs the word "complete," which is written on the order, the original of which is filed by the operator. A copy of the order is then delivered to the conductor and engineer. The engineman also reads the order to the fireman who repeats it back to him, and the conductor reads it to his brakemen and flagman, who also repeat it back to him. When the order has been thus read and reread until it is absolutely certain that every person on the train has the same exact understanding of the conditions under which it is to move, the conductor raises his hand; again the engineman places his hand on the throttle, and the train moves out of the yard and upon the main track.

In case of a passenger train leaving a terminal, or a freight train leaving a yard on regular schedule, it may in many instances run according to schedule without such special order. The schedule specifies its time at different stations, the points at which it will pass or be passed by other trains; and contains general rules whereby trains of a superior class are designated and are given right of way over trains of any inferior class which must take siding when necessary to let them pass. If, however, upon a busy road and from a busy yard,

a train as in the case of our third section of No. 82 is despatched when conditions are ripe for expeditious movement, an order from the train despatcher will contain some definite specification, such as "No. 3, engine 436, will wait at Crockettsville until 8:30 a. m. for 3–82, engine 312." Crockettsville is fifty miles away. To reach it by half-past eight means a run of twenty-five miles an hour, an easy achievement if the track is clear and the signals open. At the first bridge a signal man, posted with a green flag, compels a slow down because of carpenters at work upon a trestle; at the second station the semaphore indicates caution, and presently the explosion of two torpedoes by the locomotive warns the engineman to reduce speed and look ahead for an obstruction or a stop signal. These are the only incidents in the run to Crockettsville which notwithstanding is reached at the specified time and train No. 3 is met. Here the six cars of cotton are set off for the junction mills and two cars of general merchandise for the local store, and two cars of cotton goods are picked up for an eastern destination.

From station to station, with lightening load, No. 82 thus proceeds under orders received at this station and that, passing or being passed by way freight, local passenger, fast freight and through

mail trains, until it arrives at the end of the division. The conductor has taken the receipt of the agent at each station at which cars have been set off, specifying their numbers, weight, contents and certifying that the seals are in good order. At the division end he receives the receipt of the yard-master for the remaining cars, which are quickly disposed of locally or made up into another train for further despatch. From his train book he makes a report showing the initial and number of each car that has been carried in his train and the stations from and to which it has been moved. This is the "wheel report," and is forwarded to the car accountant, who from it makes entries upon his records which show the movement of each car and its location. From this the car accountant is enabled to calculate the per diem, which is the basis for settlement with other roads for the use of their cars; and the car mileage, which is embodied in a report that is transmitted for their information to the officers of various departments. A through freight train would have discharged no cars along the division and at its end would have needed only a change of locomotives and inspection of the cars, their brakes, wheels, axles and journals before continuance on its way. A local freight train would have disposed of its cars at

stations on the way and picked up cars ready to go forward in its direction. On arrival at the division terminal the conductor and train crew register at the yard office; the engineman and fireman hand in their "time slips," and proceed with the locomotive to the roundhouse and report its condition. Their names are posted on the "in" list, or register, and they are off duty until summoned by the caller at this end of the division.

At any one time on a division of a railroad through a sparsely settled region of thin traffic there may be no more than half a dozen trains, but on a division with two to six tracks in a densely settled manufacturing or mining region, there may be at any one time two or three hundred or more, and the yard for such a division may have a capacity of five thousand or more cars. By day and by night, on all the divisions of all the railroads of the United States, there run during the twenty-four hours, no fewer than two hundred thousand trains, guided and guarded by the ceaseless vigilance of enginemen, firemen, conductors, brakemen, signalmen, switchmen, train despatchers and trainmasters. This vigilance is without end, either by day or night, whatever the season, whether through the drought of the burning sun or the torrential flood, over the snow-capped mountain and across the

alkali desert. The sudden stop that sends out a flagman with the protecting signal, may give him only a pleasant walk along a meadow-lined track on a rare June day, or it may cause him to crawl in the piercing wind of a dark winter night over the sleety ties of an ice-bound trestle.

Modern and progressive practice requires that applicants for service in the transportation department meet physical tests as rigorous as those for the army, that they have good ordinary education, that they do not drink or gamble, and are not of objectionable character in other respects. They are not accepted in the service except on probation. They are obliged to learn the characteristics of the division upon which they are employed, and to pass examination in the book of rules. They are promoted from one position to another only after experience and demonstrated fitness. Discipline is no longer administered by an efficient superintendent with sudden and disconcerting severity, but an error is called to the attention of a delinquent with kindly firmness that develops into definite punishment only when the justice thereof is perceived by the sinner as well as the judge. There was a time when the typical railway superintendent was as a despot with the knout, but at this time when the successful operation of a railroad admittedly lies

in the degree of co-operation between the employes and the officers, the accredited superintendent is he in whom kindly considerateness, blended with dignity and impartial justness, elicits the confidence and commands the respect of his men.

The precaution in the selection of men is reinforced by the precaution in method, which is under continuous scrutiny and revision. If the provisions of the standard train rules were always absolutely observed there could be no accident through fault of the running arrangement. The requirements of the schedule are such that every train knows what relation of precedence it bears to every other train; switches and signals should always indicate whether or not a train may safely pass to the track beyond; when a train is moving under special orders from the despatcher it is safe within the limits of its order, and beyond that limit it must not go until it receives another order. Moreover, the superintendent and his staff maintain a daily continual inspection of men and methods, as well as of material and structures.

At the same time that trains are running to and fro over a division the supervisors and their gangs are working on the track, renewing rails, adjusting ballast, repairing culverts, replacing cattle-guards; and in the shops the forces of mechanics are building locomotives and cars and repairing

those which have been consigned to them after inspection. There is constant communication between the officers and employes of one and another of the operating departments; the train masters, chief despatchers, master mechanics and division engineers, especially being in the continual exchange of information of mutual benefit.

But in case the manifold precautions against accident fail, the finite brain forget, an imperceptibly undermined embankment be washed away, an undetectable flaw in the metal cause rail or wheel to break, or one of those unforeseeable and unavoidable calamities known as the act of Providence intervene, and there is a wreck, a telegraph office is reached in the quickest possible time. Word is sent at once to the superintendent, who starts the wrecking crew; to the train master and the supervisors, who send their gangs of workmen; to the master mechanic, who sends men to look after the cars and engines; and when necessary, to the doctors. At such a time there is no thought of expense, but only that men and material may be directed in the shortest time to the best ends.

Throughout the twenty-four hours while trains are running from one end of the division to the other, and over one division after another through-

out the system, there is flowing from every station where tickets have been sold, and where freight has been received or delivered, a stream of reports to the accounting department. Likewise in every shop, in the office of every division engineer, trainmaster and train despatcher originate vouchers covering expenditure, and reports of every hour of labor, of every transfer of material and its application. From the reports of revenue, the accounting officers compile statements which show what the earnings of each division have been per train, per train mile, per ton, per ton mile; and from the reports of disbursements are compiled statements showing what the expenditures have been on each division for each purpose. Thus each division officer is enabled to compare the performance of his division month by month and that performance with the performance of other divisions for the same time.

Between the ticket and freight agents, and the district passenger and freight agents, are proceeding an unending series of inquiries and replies as to rates and facilities for the movement of traffic. A traveling auditor drops into a station and the agent at once places the accounts in his hands, standing ready to explain anything unusual in the cash account or on the books, or to take the con-

sequences if he cannot. From the local offices there flows in steady stream to the credit of the treasurer in the local banks, the moneys that have been received for the transportation of passengers and of commodities; and in a steady stream it flows out again to the millions of employes to be disbursed by them to the merchants who supply their wants; to the dealers for the material and supplies which preserve and maintain the roads and their operations; to the political authorities for the maintenance of the Government and last of all, to the investors whose faith and capital have made the existence of the railroads possible.

The general offices are the center of the nervous system of the railroad. The division transportation officers and their subordinates, the supervisors and their gangs, the master mechanics and their forces, are of the vital organs that work within the body of the railroad. The local and traveling agents form the sensory apparatus that conveys information to, and gathers information from, the world without; a thousand and one details are disposed of by them, as through reflex action. Other matters are carried to the division headquarters, a prime nerve center where information is co-ordinated and whence instructions are issued; but the general office is the great nerve

center through which the brain performs its directive functions.

As the lobes of the brain are in continual co-operation in directing the movements of the body, so also are the general officers, the lobes of the cerebrum of the railroad company, in constant co-ordination in the fulfillment of the varied obligations which the manifold relations of the company devolve upon it. A railroad company must

1. Serve the laws of the State which granted the charter under which it maintains corporate existence, and the laws of the Federal Government in its relation to interstate traffic.

2. Organize and direct the working energies of its employes in the preservation, maintenance and operation of the road, its structures and equipment.

3. Serve and satisfy the traveling public, the commercial and industrial interests with whose welfare its own prosperity is bound, the communities to which it brings their sustenance and from which it draws its own.

4. Provide for and contribute, to the extent that may be possible, to the general welfare of its employes.

5. Produce a reasonable return upon the investments of its stock and bond holders.

In the furtherance of these ends, which under finite conditions it can hardly be claimed that any railroad company achieves in absolute perfection at any time, there are daily conferences between the heads of the different departments.

For example:

A division superintendent reports that the movement of traffic over his division is seriously hampered by a heavy grade. The general manager consults the chief engineer as to the practicability and expense of making an effective reduction in the grade, and the comptroller as to the present cost of operation over that division. If calculation shows that through the running of longer and heavier trains the operating expenses can be reduced to an extent sufficient to save the interest on the cost of the grade reduction, the proposition is formulated in detail by the traffic, operating and financial vice-presidents. If the cost is within the limit which the vice-presidents are permitted to directly authorize, they dispose of the matter. If the cost exceeds this limit the project is favorably recommended to the president, to be by him passed upon or submitted to the executive committee or the board of directors.

Suppose a manufacturer desires to establish a new industry—for example, a cement plant at a

place adjacent to supplies of coal and limestone. The proposition is made to the superintendent who examines its general feasibility and reports it to the general manager, stating that there will be required a side track, possibly a new station building, rates on limestone and coal to the plant and on cement to the markets; that the plant will engage the services of about fifty workmen, who, with their families and the foremen and the other attaches, will make a village of about three hundred persons. The traffic manager studies the markets that the cement can possibly reach, the rates that will be necessary; estimates the total amount of business that the new plant will likely bring to the road. The chief engineer reports as to the acquisition of the necessary real estate, the expense of building the track and station. The general manager reports as to the arrangement that will facilitate the switching and movement of cars. If the consensus of opinion is that the revenue likely to be derived will justify the expenditure, the proposition is submitted to the president and by him, if necessary, to the board of directors.

If the facilities of the company appear to be overtaxed, there is consultation between the traffic and the operating vice-presidents as to whether the demand is extraordinary and tem-

porary, or a natural increase that will continue. There is first an inspection of methods to obtain assurance that there is no clogging of the yards and tracks because of defective operation; and then there is considered the enlargement of yards, the construction of new tracks, the purchase of new locomotives and new cars. This compels analysis of the situation as affecting the traffic and the operation. The comptroller analyzes the performance of the present equipment and estimates the probable efficiency, and effect upon the revenues, of the proposed increase; and the treasurer reports as to the best way to finance the purchase. A detailed statement of the entire subject with the recommendations of the various vice-presidents is thereupon made to the president for his recommendation to the board of directors.

When it is proposed to construct a new line to new traffic sources or new markets, a special representative usually drives over the country, gathering information as to the character and volume of business in sight and capable of development. Then the chief engineer puts a surveying corps in the field; estimates are made of the cost; the chief engineer, operating and traffic vice-presidents, comptroller and treasurer consider the proposition, usually in consultation

with the president, through whom it reaches the board of directors.

The differing effect of the climatic conditions of the varying seasons upon track and equipment and upon the volume of traffic usually necessitates a change in the schedule of passenger trains for the winter and for the summer. During the continuance of a schedule the station agents, traveling and district passenger agents report to the general passenger agent any points that seem to them to indicate the possibility of improvement in train arrangement or running time; the train despatchers and superintendents and the general superintendent of transportation likewise make reports of any defects in or points of possible improvement in the schedule which are sent to the general manager. These memoranda are sifted and alternate plans formulated. In the autumn, when it is time to consider the winter schedule, and in the spring, when it is time to consider the summer schedule, a meeting is called of the operating officials and the passenger traffic officials. The proposed alterations in the schedule are discussed in detail in the light of their effect upon local traffic; upon through traffic as affected by the making or missing of connections with other roads; upon the mail traffic by changes in the leaving or arriving time at important centers;

upon the freight traffic by reason of the intervals which are left for the movement of freight trains; upon the supply of cars; upon the arrangement of train crews, and upon the expense of operation. At this meeting the leaving and arriving time of trains at terminal and the principal intermediate stations are agreed upon, and this information is furnished to the superintendents who make up the schedules in detail. If, however, it seems desirable to increase the service by establishing additional trains, or in other ways to materially increase the expense of operation, such a proposition is referred to the vice-presidents, and if necessary by them to the president.

The adjustment of through rates with connecting lines, and the apportionment thereof between the different lines over which through business passes is the cause of much correspondence in the traffic manager's office, and the questions involved absorb much of his time, frequently obliging him to obtain from the accounting department statements of the amount of business delivered to and received from connecting lines at various junction points.

The adjustment of wages in approximate equilibrium with changes in the general conditions of business is a most difficult question that often

involves the consultation of all of the vice-presidents and the president. If there is under consideration, for example, an increase in the wages of the telegraph operators, the superintendent of telegraph consults the general manager who will probably confer with the operating vice-president, who will obtain from the comptroller a statement of the wages of operators on different portions of the system; and these are compared with the wages paid by other railroads to operators under similar conditions. If disagreement as to the scale of wages becomes threatening, each vice-president analyzes the probable consequences of any extraordinary event upon the functions of his department. The general effect however, of frank discussion between the officers and employees and the tendency toward the equalization of wages is a factor in decreasing the number of unreasonable demands and strikes.

At a place where there are extensive shops, or at a division terminal where trainmen away from their homes spend hours off duty, it is becoming a general custom of a railroad company to provide or contribute to the provision of suitable quarters for the rest and recreation of its employes. Sometimes appropriations for this purpose are made to the Young Men's Christian

Association, which through its railroad department gives special attention to such needs of railroad men; or in furtherance of a growing custom, a railroad company itself erects a number of "rest houses" at appropriate locations, which are placed under the care of an organization formed to look after them and promote their use. Discussion as to the erection of such a house is usually between the general manager and the chief engineer who consider the acquisition of the necessary real estate and the probable cost of the building.

Nearly every important proposition that has to do with a lease, a purchase or a sale, necessitates the preparation and execution of contracts between the railroad company and those with whom it enters into the stipulated arrangements, and therefore a call is made for the services of the general counsel or other representative of the legal department. His opinion is also sought in the construction of disputed contracts, in the settlement of claims, and as to the advisability of commencing litigation for any reason.

Upon the legal department also falls the burden of determining the effect upon the practice of the company of the ordinances passed by various municipalities, the statutes made by State Legislatures and the laws enacted by the Federal Government.

That these various laws are not always easy of interpretation is well known, and by no one better than those railroad managers, whose full intent and desire is to obey the law.

VII

INTEGRATION

Although the builders and managers of the first railroads in the United States early exchanged ideas with each other and studied the methods of England, there arose great diversity of structure and of practice in operation. When the railroads were short and had no connection one with another, the methods pursued by each were sufficient unto itself. As they were extended so that the tracks of one joined with the tracks of another it became convenient to so arrange time schedules that the trains of each road would connect with those of the other; and to maintain this connection it was, of course, necessary that changes in the schedules of the connecting roads be made on the same day. As the railroads stretched from one city to another until there were through routes in every direction the arrangement of the through schedules necessitated a conference of the officers charged with their making. Therefore was called The General Time Convention, of whose sessions there is record extending back to 1872.

An early railroad reaching from and designed

to serve the needs of a particular city naturally designated the time of its trains in its schedule by the time used in that city, for it obviously would have been confusing and impracticable to vary the time standard at each station in exact accordance with the meridian of that station. As the railroads were built through from one city to another this confusion of time arose between one railroad and another, different railroads entering the same terminal station from different directions frequently using different time standards for their trains. After painstaking investigation, consideration and preliminary arrangement of detail by Mr. W. F. Allen, Secretary of the General Time Convention, there was adopted the present system, whereunder there are four different standards of time for the entire United States, the Eastern, Central, Mountain, and Pacific, each of which varies one hour from the other, being the times of the 75th, 90th, 105th and the 120th Meridians west of Greenwich. On November 18, 1883, this system was placed in effect by the railroads of the United States, supplanting over fifty standards theretofore in use, each differing from the other by a perplexingly odd number of minutes. For example, trains of the Pennsylvania railroad entering Pittsburg ran according to Philadelphia time,

which was nineteen minutes faster than Pittsburg time; trains leaving Pittsburg for the West ran according to Columbus time which was twelve minutes slower than Pittsburg time, while one or two of the local railroads used Pittsburg time. The standard time inaugurated by the railroads was also adopted by nearly all of the principal cities and towns, an adjustment the convenience of which is fully appreciated only by those who lived and worked under the old regime.

The individually developed practice of the different railroads had also led to great diversity in the significance of signals. That communication between trainmen, enginemen, switchmen and stationmen, which is given by the motion of hands and arms, the waving of a flag, the blowing of whistles and by the position of a semaphore or the display of a light, had reached approximately similar stages of development on the different railroads, but the woful lack of uniformity was especially dangerous at a terminal station or a crossing where different roads attached different meanings to the same signal; and was a source of danger to any road employing a man who had become habituated to the signals of another. Committees of the General Time Convention laboriously collected and tabulated all of the signals used by the

different railroads and the significance of each. After careful deliberation was formulated the code of hand, lamp, whistle, color, bellcord and semaphore signals which took effect November 16th, 1884, and is now standard for the United States. How simple is the basis for these standard signals is exemplified by those adopted for the hand, in the determination of which it was sought to follow natural impulse. A man standing by the side of a railroad track on which there were an approaching train which he had no inclination to stop, would naturally stand in an upright position with his arms at perpendicular. Therefore the "go-ahead" signal consists in raising the arms, either with or without a lantern or flag, up and down perpendicularly. A man desiring to stop a train would rush to the track and wave his hands across it; therefore the signal to "stop" is the moving of the hands, either with or without a flag or lantern, back and forth horizontally. By analogy the safety position of a target is with the semaphore arm at perpendicular; the danger position with the semaphore arm extending horizontally; the caution position is with the semaphore arm extending diagonally.

In 1891, the General Time Convention, with which the Southern Railway Time Convention had amalgamated in 1886, changed its name to the

American Railway Association. The standardization of method was continued by the formulation and adoption of a standard code of train rules in which there had been even a greater difference on various roads than in signals. This standard code contains rules for single track operation, for double track operation; it specifies the form and application of telegraphic train orders, block-signals and of interlocking rules. Among the other work of this Association, which meets semi-annually, has been the adoption of car service rules covering the use of the cars of one upon the line of another railroad, and the prescription of the educational and physical qualifications of employees. It has discussed and continues to discuss every phase of every problem of operation and construction, and its decisions are in the main promptly conformed to by nearly all, and by all of the important railroads of the country.

A meeting of the American Railway Association is a supreme council, deriving its authority from and resting its influence upon the separate companies. Its deliberations are thorough; even the wording, the arrangement and the different sizes of type—each of which has a special significance—of the train schedule, a copy of which is receipted for by each trainman, are determined by its dicta.

In the conduct of its deliberations and the announcement of its decisions, it is guided absolutely by the desire to attain results that will promote the excellence of the railroads and the efficiency of their operation; there is not the shadow of political influence, not the remotest flavor of currying favor either with the stockholders or with the populace. Those who attend its conventions, who participate in the work of its committees receive no pay for their time or their service. Their work is performed in the atmosphere of high endeavor, and their reward is the satisfaction of useful achievement.

The efficiency of the American Railway Association has been materially enhanced by the work of the Master Carbuilders' Association and The American Railway Master Mechanics' Association, the former organized in 1867, and the latter in 1868.

It was a first object of the Master Carbuilders' Association to bring about uniformity along the most desirable lines in the construction of both passenger and freight cars. To this end it has year after year studied through its committees, and discussed at its meetings, every question from the outer dimensions of a car to the size and position and material best adapted to each minutest part. The result is that the cars used on the railroads of the United States are now for the most part

built in conformity with designs approved by the Association, and their parts have become so standardized that nearly every car of any railroad can be repaired at any railroad shop with wheels, trucks, pinions, bolts and the myriad minor bits of mechanism that are made after the standard designs in standard sizes by every manufacturer. The simplifying convenience of these standards is indicated by the fact that a standard passenger coach has five hundred and twenty-five different parts, each bearing a specific name. This Association spent many years in investigation of and experiment with different types of car couplers and it designates those which are acceptable for use. It formulated the rules that govern the responsibility of different railroads for repairs to cars and instructions as to the methods of making the repairs and billing the expense. The rules and recommendations of this Association are subject to continual modifications that result from the incessant consideration of and experiment with new inventions and the necessity for the construction of cars of even larger capacity and improved pattern. Steel cars and wooden cars with steel underframing have occupied a good portion of its attention during the last ten years.

The attention that the Master Carbuilders'

Association has given to the car has been equaled, if not excelled, by the care and study which the American Railway Master Mechanics' Association has given to the locomotive. The proceedings of this Association can only be compared to the discussions of the medical and surgical societies. The anatomy of the locomotive is fairly comparable in variety and delicacy to that of the human body, and its physiology would seem to demand care almost as great. To read the discussions of the Association, to follow its investigations, tests and experiments and standardization of parts, is to follow the development of locomotives and of the shops and machinery engaged in their manufacture and repair. This Association has established four scholarships at the Stevens' Institute of Technology.

The three Associations that have been named have been the foremost instruments in perfecting and securing the adoption throughout the United States of all that has been decided to be best in structure and method that pertains to the operation of the railroads. The discussions in the American Railway Association that preceded the adoption of the Standard Rules, in grasp of principle and elucidation of detail, carry a reminder of the debates on the National Constitution that are chronicled in the

"Federalist," and the discussions of the three Associations are ever extending to questions of wider import and more delicate application.

Improvement in the construction and operation of the railroads has also been furthered by the American Railway Engineering and Maintenance of Way Association, which considers questions pertaining to the construction and maintenance of track, bridges and buildings; by the Railway Signal Association, which seeks to develop the construction and maintenance of railway signalling appliances and to improve signal practice; by the International Association of Car Accountants and Car Service Officers, which has improved and introduced uniformity in the methods of car accounting and car service; by the Association of Railway Telegraph Superintendents, which seeks to improve the construction of telegraph lines and the methods of telegraph practice; by the Train Despatchers' Association of America, which considers the best methods of directing the movement of trains by telegraph.

That they might arrange the details involved in the preparation, sale and acceptance of through tickets, the General Passenger Agents first met in convention in 1855. The American Association of General Passenger and Ticket Agents, which

was then formed, has met annually. Through its agency has been developed that system whereby a ticket can be purchased at almost any station for travel to nearly any other station in the United States. This Association in its earlier days also determined and arranged for the publication of through rates of fare and their apportionment between the different lines, a duty that now devolves upon local associations. The General Passenger Agents have standardized the forms of through tickets and established an organization for the protection of railroads from the misuse of tickets through alteration and forgery.

Inasmuch as the interline or coupon ticketing system and methods of settlement were devised by the General Passenger Agents, the rules and methods of settlement for car repairs by the Master Carbuilders' Association, and the rules and terms for the use of cars by the American Railway Association, definite and regular intercourse between the officers of the various accounting departments was not inaugurated as early as that between the officers of other departments. The Association of American Railway Accounting Officers, which was formed in 1888, has, however, made up for its late start by the excellence of its performance. An early and most important achievement of this

Association was the improvement and extension of the interline way-billing system. It has formulated in connection with the Statistician of the Interstate Commerce Commission a classification of accounts. It discusses and determines problems in connection with railway accounting, especially as to the methods of ascertaining balances between the different companies, and procuring definiteness and promptness in their settlement.

Through the various national, district and local associations of which the more important have been enumerated, there has been given definiteness to the tendency toward uniformity of structure and method throughout the United States, with due allowance for variation in accordance with particular conditions in different localities; and without undue hastening of transformation on the part of railroads of small income upon whom it is but just that the expense of adopting new appliances and new methods fall gradually.

It goes without saying that a track across a frontier prairie, over which pass no more than half a dozen trains a day, does not need to be of the solid structure or to have the elaborate signal appliances of a trunk line. Now and then is heard the statement that the American railroads are not of the staunch construction of those of England,

it being forgotten that the countries of Europe had a relatively dense population and well-defined channels of transportation at the time railroads were introduced. It was well enough that the railroads covering the short distances of Great Britain should be built at the start with massive masonry, without grade crossings and be abundantly protected from trespassers, but in the United States where it was necessary to stretch the railroads across vast and undeveloped regions they had to be built as best they could. It would be folly to claim that the best possible was done in all cases; it is noteworthy, however, that but a few years ago a competent calculation showed that if the railroads of this country had been at that time upon the British scale of massiveness and as thoroughly safeguarded, the additional cost of construction would have been at the rate of nearly half a million of dollars per person killed upon the railroads during that year.

Nor can it be claimed that all of the American railroads at all times and in all places have improved their structures and methods, abolished grade crossings and adopted safety appliances with the rapidity that their revenues would have permitted or that a complete regard for the demands of decency would have compelled. It hardly needs proof,

however, that the gross derelicts are exceptional. At times the efforts of railroad commissions to force and hasten the adoption of improvements have imposed a heavy burden upon the treasury of weak railroads. This has in cases resulted in their making expenditure for appliances that had not at the time received the entire approval of railroad experts, and that have been inferior to subsequent inventions of which these roads could not avail because of the burden of the expenditure already made.

The acceleration of the tendency toward uniformity in structure and practice of the railroads of the United States, through the various American Associations, finds analogy in the action of the International Railway Congress which was organized at Brussels in 1885, and attended then principally by delegates from the countries of th' ıtinent. It meets every five years, and its third session was in an English speaking country—at London in 1895. Its last several sessions have been attended by delegates from the United States appointed by the American Railway Association, and the annals of this Association for 1905 are memorable, because in May of that year the International Railway Congress met at Washington. There were five hundred and seventy-four delegates from thirty-

seven countries. All the nations of Europe were represented, as were delegates from South America, Africa, Australia and New Zealand. Over fifty well-prepared papers were printed in both French and English, and distributed among the delegates for their consideration prior to the discussions. These papers contained the outcome of investigations which had been assigned to expert railroad men of various nationalities, in five sections as follows:

(a) Ways and Works.
(b) Locomotives and Rolling Stock.
(c) Working and Operation.
(d) General.
(e) Light Railways.

Under the first section there were papers on (1) Wooden Sleepers and Crossties; (2) Rules for Lines with Fast Trains; (3) Improved Rail Crossings; (4) Concrete or Embedded Metal.

Under the second section were discussed (1) The Increased Power of Locomotives; (2) The Pooling of Locomotives; (3) Automatic Couplers; (4) Electric Traction.

Under the third section the topics were (1) Lighting, Heating and Ventilation of Trains; (2) Automatic Block Signaling; (3) Important

Improvements in Fixed Gears; (4) Baggage and Express Parcels; (5) Suburban Traffic.

Under the fourth section the topics were (1) Rates on Freight Traffic; (2) Accounting and Statistics, (3) Duration and Regulation of Work; (4) Employes' Insurance and Pension Institutions.

Papers on each subject were presented by railroad officers from different countries of contrasting practice. The discussions were general and often animated, leading to conclusions adopted by vote of the Congress. While because of the different conditions in the various parts of the world these conclusions were general expressions often arrived at through compromise and not capable of immediate and definite application, they represent in a measure the collective wisdom of the railroad world of all nations for five years. A principal benefit of this Congress lies in the opportunity for the acquaintance of the delegates and that quiet, informal exchange of views which is often of more important effect than debates in convention. This opportunity for personal intercourse between the corresponding officers of the different railroads is generally recognized as a most valuable feature of all railroad conventions.

This lecture should not conclude without

reference to the fact that in the United States, with the integration that has been developed through the co-operation of the officers of the working organizations, there has gone side by side a certain corporate integration akin to that industrial and commercial integration which has been made conspicuous through the formation of the large industrial and commercial corporations of the past decade.

When two or more railroads have extended to connection so that they form a through route between two considerable cities, or between a great producing and great consuming region, it is obvious that facility and economy can be attained in their operation if they are combined under one management. The equipment can be utilized to the best advantage over the entire line; one set of administrative officers, general office clerks and soliciting agents can attend to the business of a greater as well as of a lesser number of miles. Thus, the perception and enterprise of Commodore Vanderbilt led to the welding together of the dozen or more local roads between New York and Buffalo into the through line between those cities now operated by the New York Central and Hudson River Railroad Company. In like manner, the Penn-

sylvania Railroad brought together the separate railroads between Philadelphia and Pittsburg. After such a through line has been formed, branch lines and transverse lines penetrating adjacent territory and bringing traffic therefrom to the main stem have been incorporated in the same company. Nearly every principal railroad system in the United States has attained its present mileage largely by this amalgamation of connecting and of tributary lines, many of them being composed of thirty or forty or even fifty or sixty merged corporations. This amalgamation has proceeded in most cases simultaneously with the construction of extensions and branches, until in the particular region which it serves a railroad company has lines reaching not only to the principal but to the minor commercial centers, and to each portion of that territory from which traffic can profitably be derived, or in which it can be profitably marketed.

This tendency toward the completeness of each system in its traffic relations has led to the extension of the principal systems by construction and by absorption of smaller lines, until at present within each region of well defined geographic and physical boundaries there are but few, sometimes no more than two or three great systems, the small and

so-called independent lines having been almost entirely absorbed by them.

That this amalgamation of the transportation agencies into larger and larger units is but one phase of that all pervading evolution which controls the actions of men as well as of all progress in the inanimate or the animate world, is being more and more widely recognized. There was first the individual artisan; then master and apprentice, forming a larger unit; there followed the partnership, the corporation, and through the so-called trust was reached the larger corporation. Indeed the formation of the tremendous industrial corporations of the last decade compelled that further unifying of railroad corporations through what has been designated "community of interest." When one industrial corporation confronts two or more railroads it can play one against the other; when these two or more railroads present a common front they are no longer helpless.

That in the formation and administration of these huge railroad mergers, as well as in the formation and administration of the enormous industrial combinations, there have been great abuses is unquestionable, but every exposure of iniquity is, in a measure, a preventative of its repetition or continuance. That these amalga-

mations have not destroyed competition, but have simply made greater the units of competition, has also become evident. That the friction of one upon another under the guidance of an enlightened public opinion will ultimately lead to their serving the public with the greatest good to the greatest number, is not only the hope but the belief of those who are studying the progress of events with faith in the underlying sanity of the American citizen.

VIII

RELATIONS TO THE PUBLIC AND THE STATE

Although the duties of the railroad service manifestly differ from those in other fields of industry, it will be perceived upon analysis that the essential service rendered by the transportation industry is a process so interlinked with those of other industries in the production of commodities at the place of use, as to be a constituent part of those processes, from which indeed it differs more in degree than in kind. Wherein, for example, does the service that transports the iron ore from the mine to the distant furnace differ from the service that transports the metal from the trough, in one part of the works, to the rolls in the other? In the one case, material is taken to where it is fashioned from a crude to a more refined state; in the other, material is taken to where it is fashioned from a crude into a more definite form. The process is the same in kind, contributing to the same end.

As an element in the production of cotton cloth, wherein does the transportation of cotton

from the field to the compress, differ from its transportation from the carding to the spinning room, or even from the transportation of the threads in the bobbin from the warp to the woof?

The complex products of civilization are each formed of varied materials, each of which is taken from its virgin condition and goes through a series of processes, which involve motion over shorter or longer distances. It is thus wrought to that stage which fits it for combination with the other materials, each of which has likewise gone through a succession of processes. As raw material is fashioned step by step, through various stages, into the finished form, it is being brought within use; and so also every link in every chain of the transportation through which commodities are carried to the place of need is a step whereby those commodities are brought into use. Whether the mechanism be that of the wheelbarrow, the traveling crane or the locomotive, the service is similar in kind; and even for a wheelbarrow there must be the original cost, expenditure for repairs, and wage for the employe that propels it. If the compress be at the edge of the plantation, cotton may be carried to it in the arms of the pickers; if it be a mile away, the agency may be the wheelbarrow or the wagon; if one

hundred miles away, the railroad. The service is the same in kind contributing to the same end.

A prime factor in determining the price at which an article is sold is the cost of production. This cost of production is made up of the aggregate of the costs of the various stages through which each material passes. For example, the mines, the railroads, the furnaces, the mills, and the railroads again all entail a share of the cost which places a ton of structural steel at the foot of the building in whose structure it is to be placed. The revenue of the mines provides for their maintenance and the wages of their laborers; the revenue of the furnaces and mills provides for their maintenance and for the wages of their employes; likewise the revenue of the railroads provides for their maintenance and for the wages of their employes. How can the processes of transportation be separated from the processes of manufacture?

The prices of commodities are determined in the market under supply and demand, by contests between buyers and sellers. Whether commodities are scarce or plentiful the prices range between the highest that the purchaser will pay and the lowest the seller will take, the exact selling price being the resultant of a variety of factors of which the cost of production is one, no article being sold at

less than this cost for any extended period: a railroad company likewise does not sell transportation at less than cost for any extended period, the unit not being the cost of any single act of transportation, however, but of the total cost. In the application of "what the traffic will bear" to particular kinds of transportation a railroad is far more conservative than the ordinary trader, for it is the very trading instinct to buy at the lowest and sell at the highest price, that is, to determine the price by "what the traffic will bear."

The founders of our nation were well aware that whenever a government has endeavored to set aside the economic laws by which prices are regulated, and to regulate those prices by governmental edict there has been retardation of industry and consequent harm to the people. The spirit of American institutions has been that of individualism, of leaving men to progress by their own valors.

It is widely held, however, that the determination of the prices for transportation should be under governmental control or regulation, a vague expression which is variously interpreted all the way from preventing through process of the courts the charge of an unreasonable rate, to the definite fixing of specific rates by governmental bureau or

commission. The right of resort to the courts of a state to test the reasonableness of a rate on traffic within the limits of that state is inherent under the common law, and was conferred, in the case of traffic between one state and another, upon the Federal courts by the Interstate Commerce Act of 1887. That is, intrastate traffic has always been under governmental control, and interstate traffic has been definitely under governmental control for the past nineteen years.

One ground upon which specific governmental control of the prices charged for transportation is urged is that a railroad rate is a tax. A tax primarily is a levy for the support of a government, laid sometimes upon people, and sometimes upon commodities. A price is a measure of the services embodied in a commodity. The disposition of the revenue derived from taxation is mainly for the preservation of peace and order, and the public health; the maintenance of the conditions under which the people may carry on their vocations. The aggregate of price measures that aggregate of service which constitutes the carrying on of the vocations of the people. A railroad rate represents payment for service rendered, a service that enters into the cost of production of commodities, and with other factors,

constitutes that cost of production. It, therefore, in no sense is a tax; a railroad rate is not a levy but a measure of service. That is, how can the transportation charge be designated a tax any more than any other charge entering into the cost of producing a commodity? If it were true that the freight charge was a tax, a large portion of the value of every article of food, of clothing, of every structure is a tax, and inasmuch as certain states tax the earnings of the railroads, they would be imposing a tax upon a tax.

Other arguments urged in favor of the regulation of railroad rates are, that inasmuch as the service of the railroads is essential to the welfare of every person, as they derive their charters from the consent of the whole people, and as they are accorded the right to condemn property for their use, it is but just that their charges be so regulated as not to be a burden upon their patrons, who are in fact the entire people.

In this connection it may be pointed out that while the transportation service is essential to the welfare of the entire people, the capital which makes that service possible is accumulated and invested by the few. Moreover the bread service, the meat service, the cotton service, and so on, are essential to the welfare of the entire people. The railroads derive

their charters from the people no more than do other corporations, partnerships and individuals transacting business derive their charters and licenses from the people. There is no industry that does not depend upon use of the land and substances that grow out of or are taken from the land. A railroad company in common with certain other corporations has the power to condemn land for its use because that use is a public service. But this power is never resorted to except when unavoidable, which is often when but one lone property-holder ignores any claim the public service may have upon him and persists in refusal to part with his land. The result even in such a case is always that the railroad pays at least the value and usually more than the full market value of the land condemned. That is, just as the service rendered by the transportation industry is an integral factor inseparable from the other processes of manufacture of an article, so also is the allegiance which a railroad company owes to the State the same as that which any other corporation, firm or individual in the conduct of business owes to the State because of that conduct. A corporation is simply that which is incorporated, given a corporate entity; that is, made a person responsible for its acts as is any other person. As in the

course of industrial evolution there has been the amalgamation of smaller concerns into larger and yet larger corporations, the fact that each industry performs a public service, just as does the transportation industry, is becoming clear.

Another argument advanced in favor of the regulation of railroad charges by the government is that the railroads are monopolies or partial monopolies; that is, that they can control, or partially control, the prices for transportation. In reply to this, those charged with the administration of the railroads claim that between no two places nor at any time can they determine what the transportation charges shall be, that they simply adjust them within a limited range. They say that the coastwise rates along the Atlantic Ocean, and the Gulf, and along the Pacific, limit the rates of the railroads not only between the harbors but for considerable distances in the interior; that the transportation charges between the Northwest and the Atlantic are limited by the Great Lakes and the Erie Canal, between the West and the Gulf by the Missouri and Mississippi Rivers. From almost every considerable section to any other considerable section of the United States commodities can move by water, largely do so move and would so move in vastly greater quantities with each modicum of

increase in the rail rates. Aside from the water competition, there is the competition of different railroads, which applies between the principal industrial and commercial centres all over the United States; and in the more thickly settled regions, where there is a denser network of railroads, this competition applies generally between the cities and towns of less importance. Furthermore there is the competition of producing centre with producing centre, of market with market, of shipper with shipper. Each railroad uses its best endeavors to help the producers along its lines to find markets for their products, to bring to the markets along its lines products in competition with the markets reached by other lines, even if to accomplish these ends the rates be reduced to but little more than necessary to cover the immediate expenditure for the handling. Then there is the competition of commodity with commodity, holding down the rates on one commodity to prevent its being supplanted by another. The traffic managers say that these forces are continually in action, that it has been the freedom of the railroads to adjust rates in accordance with the play of commercial forces that has been a foremost factor in the development of the country. They state that these forces affect not only the rates charged between the principal cities

and towns, but keep down the rates between intermediate stations entirely dependent upon a single railroad. They claim that, therefore, the element of monopoly enters to a very slight extent in railroad charges, and instance the exceeding difficulty with which a rate is advanced when it has once been reduced. They argue that as a railroad company is unceasingly endeavoring to increase its traffic, it therefore must so adjust its rates that the greatest volume of commodities will find a market.

At the time of the introduction of railroads during the first half of the nineteenth century, the countries of Europe were comparatively thickly populated and supplied with established means of transportation by land and by water. Governmental scrutiny was given to propositions for railroad construction, the roads early came under governmental regulation, and in some cases under governmental ownership. At this time the United States had but a scattered population even along the early settled Atlantic seaboard. The buoyant spirit of the nation eagerly welcomed any enterprise that promised to develop its material resources, and after the feasibility of steam as a motive power had been demonstrated, the building of railroads was stimulated by cities and states

and by the nation which granted millions of acres of land as a bonus for the building of railroads through the undeveloped regions, just as for other purposes it likewise bestowed other millions of acres upon eager recipients. Although usually the charters of the railroad companies contained certain restrictions upon their tariffs, as a rule there was little attempt at specific regulation in this early period, throughout which the building of railroads was pushed with vigor that in cases partook of the recklessness induced by speculation and the desire of adventurers for immediate profits. It was not, however, thought worth while to endeavor by special legislation to protect the public from the greed of the railroads or the railroads from the greed of their patrons: this was the period of *laissez faire*.

The renewed activity that succeeded the Civil War resulted in the extension of railroads far beyond the immediate needs of the regions which they served. The ensuing strife for traffic led to discriminations between shippers and communities that in many cases were outrageous, and to rate wars that were burdensome both to the railroads and the communities. As neither shipper nor railroad knew what rates rival shippers were paying or rival railroads were charging, each shipper would

strive to undersell and each railroad to undercharge the other, and this led to a chaotic condition entailing loss upon all concerned. Different states began to establish railroad commissions, with powers varying from that of investigation and conciliation to that of prescribing rates. The wrath of the people, that was not by any means entirely without justification, caused certain of the Western states to enact over-stringent legislation, known as the "granger laws," which after a few years were found to work more injury through the repression of activity than had been entailed by the preceding lack of legislative restraint, and they were modified or repealed. State commissions have however been established at one time and another, until now in thirty-five states there are commissions of various kinds with widely different powers. The effectiveness of a commission depends of course not only upon the statute but upon the personnel. In certain states their performance has been admirable; in others their activity is negligible; in yet others by hard and fast rules they have retarded the development of the State which created them.

By act of Congress, passed in 1866, the railroads of the different states were authorized to join in the formation of through lines for the carriage of freight and passengers from one state to another.

This legislation, authorizing the through billing and through ticketing of through traffic, practically marks the development of the strife between the railroads carrying such traffic, the giving of rebates. the securing of business by fair means or foul. As the railroads hold their charters from State governments, and as there is no Federal law save such as is enacted by Congress, there was practically no appeal to the courts in so far as interstate traffic was concerned, although one or two judicial decisions are of record indicating that there was not entire absence of such relief had it been sought,

The waging of warfare and the indulgence in piratical practices was, if anything, more disastrous to the railroads than to their patrons, and the administrative officers of the rival lines endeavored incessantly to terminate the one and exterminate the other by agreements as to rates and stipulations as to their uniformity. The desire to obtain business and the pressure of communities and patrons however, was stronger than the so-called "gentlemen's agreements," none of which endured for very long. As a further step toward enforcing agreements as to rates and practices there arose the device of apportioning to each of the competing lines between principal centres a percentage of the competitive traffic. If a line secured less than its

agreed percentage the difference was made up by the other lines; if it secured more it was obliged to divide the excess between the other lines. Such an arrangement was known as a pool. Sometimes the division was made between the competing lines on the basis of tonnage, a tonnage pool; sometimes on the basis of revenue, a money pool. Heavy deposits were made by each of the agreeing lines, to be surrendered as forfeit in case of violation of the agreement. The first traffic pool was that entered into by the lines between Chicago and Omaha in 1870. The railroads of the South, that had resumed their activity under especially distressing and demoralizing conditions, entered in 1875 into an agreement drawn by the master hand of Albert Fink, who at a later date became the commissioner of the Trunk Line Association, formed in 1877.

Although perfection was not attained in the operation of the pools a certain stability was given to rates, and unjust discriminations were materially diminished. During the seventeen years of their existence, the average ton mile rates decreased from nearly two cents to about one cent, a sufficient proof that the decline in rates was not arrested because of the pools. The continual improvements in road construction and equipment and in methods of operation decreased the cost of trans-

portation, while the efforts of the traffic managers to increase the traffic by extending markets lowered the rates.

The agreements and practices unfortunately designated by the word "pool" were however never favored by the people in general. It was thought that they entrenched the railroads in monopoly and there was a violent clamor for their abolition. At that time there was, as there is now, a confusion of ideas between the cutting of rates and the granting of rebates, a misconception of the source of the genuine abuses in railroad practice. There was public agitation, unquestionably due in part to objectionable and often tyrannical conditions fostered by some railroads at some times, but also in large part due to unreasoning condemnation of many practices that have since been proved unobjectionable and often beneficial. This and the fact that there really was no Federal legislation covering interstate traffic led to the passage of the Interstate Commerce Act taking effect April 5, 1887.

This act, which practically applied the principles of the common law which inhere in the unlimited jurisdiction of the State courts to the regulation of interstate traffic by the Federal courts, provided

First: That charges for transportation must be reasonable and just; prohibiting any unjust dis-

crimination by special rates, rebates or other devices and any undue or unreasonable preferences;

Second: That there should not be a greater charge for a short haul than for a long haul over the same line in the same direction under substantially similar circumstances and conditions;

Third: Prohibited the pooling of freights and the division of earnings;

Fourth: Prohibited any device to prevent the continuous carriage of freights;

Fifth: Provided for the publicity and filing with the Commission of all tariffs;

Sixth: The Interstate Commerce Commission created by the Act is given power to investigate complaints against carriers and to make reports of its investigation in writing;

Seventh: The Interstate Commerce Commission is authorized, in case it finds that the carrier has violated the law, to order it to desist and make reparation for injury done. In case these orders are not obeyed the Commission is empowered to proceed in a summary way to have the Circuit Court of the United States enforce them.

It will be observed that there is nothing in this Act conferring power upon the Commission to fix a specific rate. It has time and again been stated by those who framed the bill that there was no

intention to confer this power, and their statement is borne out by the reports of the debate in Congress at the time.

The effectiveness of the Interstate Commerce Commission is shown by the fact that from its organization on April 5, 1887, to December 31, 1904, it had received four thousand and twelve complaints, an average of about two hundred a year, of which three thousand two hundred and twenty-three were informal and settled by friendly mediation. Of the seven hundred and eighty-nine formal complaints almost half were settled by agreement or withdrawn. Of the three hundred and fifty-nine cases of which the Commission has disposed, in the two hundred and ninety-seven formal decisions which it has rendered, a trifle more than one-half have been decided in favor of the complainants, the remainder having been dismissed. In but forty-five cases have the railroads refused or neglected to obey the orders of the Commission. Of these forty-five cases which have been appealed, the courts have rendered decisions in thirty-five, and in but three of these has the order of the Commission been sustained.

Notwithstanding this record, the Interstate Commerce Commission during the last several years has fomented agitation for the increase of its

powers, asserting that the right to determine and make effective a specific rate was conferred upon it by the original Act and taken away after its exercise for ten years. The Commission by formal resolution directed its secretary to conduct a propaganda toward having this power conferred upon it.

About two years ago the Commission caused to be circulated statements that because of increases in freight charges the railroads had obtained for the year 1903 a revenue exceeding by one hundred and fifty-five million dollars that which would have been obtained under the rates charged in 1899. These figures and others which were embodied in a report to the United States Senate, entitled Senate Document 257, the railroads at once condemned as having been obtained by inaccurate calculation from incorrect premises. The companies state that the increased revenue was but about sixty-eight million dollars; that the comparison was with the year when rates owing to the depression following the year 1893 had been reduced to the lowest level in the history of American railroads; that the rates for 1903 were less than for 1895 or any preceding year, and that moreover the increase, which was but a trifle over five per cent, was but nominal in that the prices for material consumed by the railways, and the wages paid by them, had increased

in the same period from fifteen to twenty-five per cent.

Although there had been little if any complaint as to the charge of exorbitant rates by the railroads in the preceding decade, it seldom, if ever being claimed anywhere by anybody that the rates of the American railroads have prohibited traffic from moving; although the amendment to the Interstate Commerce Law known as the Elkins Act approved February 19, 1903, materially strengthened the procedure against railroads guilty or suspected to be guilty of rebates and unjust discriminations, the agitation fomented by the Commission for the increase of its powers, together with the clamor stimulated by certain dissatisfied and for the most part unimportant shippers, who had failed to adjust themselves to the economic current, led to the passage by the House of Representatives in the spring of 1905 of the Esch-Townsend Bill, which gave the Commission authority to fix a rate and to put it in effect. This gave the Commission authority over any "rate, regulation or practice" of a railroad company.

When the bill reached the Senate it was referred to its Committee on Interstate Commerce, which arranged for a series of hearings of the

representatives of all interests involved. The testimony taken by that Committee formed the basis of the elaborate discussion which continued in the press and at public meetings until the convening of the Fifty-Ninth Congress in December, 1905. The message of the President to Congress at that time stated that legislation was needed not so much to prevent the imposition of rates unreasonable in themselves, but to prevent unjust discriminations between persons and places, and that therefore the Interstate Commerce Commission should be empowered to determine upon complaint what should be the maximum rate thereafter to be charged by the carrier, which should be in effect unless reversed by the courts.

The Hepburn Bill was introduced in the House of Representatives and passed by that body on February 8, 1906. It contained provision for the fixing of a maximum rate by the Commission, but did not modify the existing law in regard to rebates, and made no provision for the appeal by a railroad to the Federal Courts in case it should desire to contest a rate fixing order.

The Hepburn Bill was referred by the Senate to the Committee on Interstate Commerce, which after deliberation extending over several weeks, reported it without amendment and without recom-

mendation. Thereupon ensued a memorable debate which, however, was but little concerned with the economic phases of transportation, or with the voluminous evidence taken by the Senate Committee on the general subject during its hearings of the previous Spring. The speeches dwelt almost entirely upon the legal aspects, it being evident that the Senate desired to pass an adequate bill that would be constitutional; many doubts had been expressed that the Hepburn Bill would meet this test.

During the Session numerous bills, other than that proposed by Representative Hepburn, were introduced in both Houses, the most conspicuous bearing the name of Senator Foraker. The senior Senator from Ohio frankly opposed the Hepburn Bill from the start. In his opinion the clause of the Constitution, according to Congress, the right to "regulate" commerce between the states and territories could not be construed into authorizing Congress to definitely fix, or delegate the power to fix, under any circumstances, a specific rate for transportation. He held that relief from unjust practices of the railroads and abuses in their administration should be obtained by direct resort to the courts; and his bill provided that at the instance of a complainant, there should be instant

prosecution at the expense of the government, before a Federal court, which would restrain an extortionate rate, rebate or discrimination.

The discussion, however, centered upon the Hepburn Bill, which had been passed by the House and was favored by the President of the United States. With various amendments, it was passed by the Senate, and after prolonged consideration by the Conference Committee, was finally passed and approved June 29th. By joint resolution it took effect sixty days thereafter, on August 28, 1906.

The Bill provides

(a) That as "common carriers" under the Interstate Commerce Law shall be included companies transporting oil by pipe lines, express companies, sleeping car companies, all switches, tracks, terminal facilities, and that "transportation" under the law shall include all cars regardless of their ownership, and all service in transit.

(b) Prohibits the issue of passes, with certain specified exceptions that cover mainly employes, either direct or collateral, and for religious and charitable purposes; fixing a penalty in case of violation that shall apply to both the giver and the recipient.

(c) Makes it unlawful after May 1st, 1908, for

any railroad company to transport for sale any commodities in which it may have a proprietary interest, except lumber and its products.

(d) Provides that a common carrier shall provide, when practicable, and upon reasonable terms, a switch connection for any applicant who shall furnish sufficient business to justify its operation.

(e) Makes more explicit the specification as to the filing of tariffs, especially providing for the posting and filing of through tariffs, and the acceptance of the through rates quoted in such tariffs by such carriers as participate therein; fixing penalty for violation.

(f) Provides that "every person or corporation, whether carrier or shipper, who shall knowingly offer, grant, give or solicit, or accept, or receive rebates, concession, or discrimination, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not less than one thousand or more than twenty thousand dollars." Moreover, any person, whether officer or director, agent or employe convicted of such misdemeanor "shall be liable to imprisonment in the penitentiary for a term not exceeding two years, or both fine and imprisonment in the discretion of the court."

In addition, the acceptor of any rebate shall

forfeit to the United States three times the amount of the rebate.

(g) Provides for the publication of the reports and the decisions of the Commission and their acceptance as evidence.

(h) Empowers the Commission, if upon complaint it finds that a rate, or any regulation or practice affecting a rate, is "unjust or unreasonable, or unjustly discriminatory, or unduly preferential, or prejudicial," to determine and prescribe a maximum rate to be charged thereafter and modify the regulation or practice pertaining thereto. This includes the prescription of a through rate and the apportionment thereof between the carriers parties thereto. Orders of the Commission shall take effect in not less than thirty days and continue in force not exceeding two years, unless suspended or set aside by the Commission or a court of competent jurisdiction.

(i) Empowers the Commission to award damages against a carrier in favor of a complainant.

(j) Provides for forfeit to the United States, in case of neglect to obey an order of the Commission, in the sum of five thousand dollars for each offense, each violation and each day of its continuance to be deemed a separate offense.

(k) Empowers the Commission to apply to a

circuit court for the enforcement of its order, other than for the payment of money; for the appeal by either party to the Supreme Court of the United States; and that no order of the Commission shall be suspended or restrained, except on hearing, after not less than five days' notice to the Commission.

(l) Provides for the rehearing by the Commission, upon application, at its discretion.

(m) Authorizes the Commission to require annual reports from all common carriers, that shall contain specified information; to prescribe the form of any and all accounts, records and memoranda to be kept by carriers, making it unlawful for the carriers to keep any other accounts, records, or memoranda than those prescribed and approved by the Commission; provides that all accounts of the carriers shall be open to the inspection of the special agents, or examiners employed by the Commission.

(n) Provides that a common carrier issuing a through bill of lading shall be responsible for loss, damage or injury to the property covered thereby upon the lines of any company over which it may pass, leaving it to the line issuing the way-bill to gain recovery from another line upon which the loss, damage, or injury may have occurred.

(o) Enlarges the Interstate Commerce Commission from five to seven members, with terms of

seven years, increasing the salary from seven thousand five hundred to ten thousand dollars per annum.

Throughout the public discussion prior to the convening of the Fifty-ninth Congress, the railroads had declared that rebates were practically of the past; that there was abundant provision in the Interstate Commerce law and the Elkins law for the detection, prosecution and punishment of offenders in this respect if the Interstate Commerce Commission would avail of the authority conferred upon it under these laws. The former claim was in the main disproved and the latter substantiated, during the months immediately preceding the enactment of the Hepburn Bill, by the fact that the Commission, through investigation and prosecution more vigorous than had been its wont, discovered many cases of rebates and brought the offenders to penalty. Inasmuch as the railroads had besought Congress, for their own protection, to strengthen the law against rebates, if such strengthening were possible, it is fair to presume that the drastic provisions inserted by the Senate in the Hepburn Bill meet with the concurrence and the acceptance of the railroads and the public alike.

Investigation of the Commission in the year prior to the enactment of the Hepburn Bill also

unearthed other practices of certain railroads that were condemned by the public in general; their exposure seems certain to act as a substantial preventative of their recurrence.

There is reason to hope that the diffusion of knowledge as to the underlying principles of correct railroad practice, together with well-balanced action of the Commission under the new law, will lead to a better and wider accord between those charged with the administration of the railroads, the public whom they serve, and the Government to whom they are responsible.

The relations borne by the different states through their respective railroad commissions to the railroads are paralleled in diversity by the methods adopted in one and another to arrive at a basis of taxation for railroad property. The anxiety to encourage the building of railroads in the decade immediately following their introduction led in many places to their exemption from taxation. This status however was quickly outgrown and it became customary to tax the railroads on the value of their property, as citizens in general were taxed. It often happened that different boards of assessors in different counties placed different valuations on similar property of the same railroad; and the determination of the

assessment on the rolling stock which was continuously in transit from one county to another, was only one of the many perplexing problems which have led several states to have the valuation of the railroads assessed by a state board, and then apportioned between the several counties who collect their respective allotments of the tax. A few states have adopted the plan of collecting the total tax, which is then distributed among the counties At the best however it is very difficult to arrive at a property valuation.

In some states the capitalization and in others the cash value of the capitalization is made the basis for assessment. In certain of the states the stocks and bonds and in others the stocks alone of railroad companies are the basis, a method which has the merit of simplicity. In yet other states the gross receipts are the basis of taxation, a method which causes the amount of the tax to fluctuate as the ebb and flow of prosperity affects the volume of traffic. It is a basis which is readily understood however, by state officers and the people generally, and is not susceptible of manipulation; and fluctuations can be met by readjustments of the rates. In other states the net earnings are taxed, a method not only undesirable because of fluctuation in the traffic, but

subject to the further objection that all railroads do not arrive at their net earnings by the same method of accounting. Great perplexity has also been caused by the fact that each state can only tax the property of a railroad within that state, whereas there are many railroads each of which traverses several states.

Out of all this medley of method there is evident a tendency toward centralization of the assessing power in the various states in a State Board, instead of leaving it with local authorities and a tendency toward a uniformity of method in the different states taking cognizance not only of the value of a property but of its capitalization and its earnings,

On the ground that the transportation function is a public service there has at many times and in many places been the endeavor by governmental enactment to limit the profits of a railroad company, the argument usually being that it should be allowed to earn no more than a reasonable return upon the actual capital invested, and that further profits should be given to the public in the way of lower transportation charges. The rigid enforcement of such a policy would in the case of the established and prosperous railway systems destroy the incentive to the improvements in operation

that result from skilled and progressive management, and would in the newer regions, where profits are hazardous and the possibility of a large return is necessary to tempt the investor, seriously retard railway extension. After investors have given of their capital, and engineers and managers of their energy to build and equip a road, dividends are oftentimes not earned for many years. It would seem unfair that when their efforts have reached fruition, the share in the prosperity of the region which the railroad has developed, should be limited to a return no greater than the interest on funds advanced on stable securities. This more or less widespread feeling against the earnings of large dividends has led more than one railroad company to conceal, during times of prosperity, the amount of its net earnings by the gratis distribution of additional capital stock representing no actual addition to the company's assets, one of the processes designated as "stock watering." The dividends being distributed over the greater amount of stock, the rate of dividends is kept down. It is noteworthy however that notwithstanding this and other devices that make for over-capitalization, the capitalization per mile of the American railroads is far less than that of any of the European countries. So eminent an authority as President

Hadley has said that the American railways could not be duplicated for the amount of their present capitalization.

It is being more widely acknowledged that the test of capitalization of various enterprises is not always logically the amount of bare cash invested. A factory located advantageously between the sources of raw material and the markets for the finished product will succeed, while a factory disadvantageously located will fail, although the same amount of money may have been invested in each plant. These opposite results also often mark the difference between a skilfully, thriftily operated plant and one that is not. Is it fair that the good judgment or the skill exercised in the one case should not receive the full measure of its reward? Is this any more fair than to decree that a capable industrious workman shall receive no more wage than his less skilled and shiftless neighbor? Moreover years of fat are followed by years of lean; the high profits of five years of prosperity may be succeeded by the absence of profits during five years of adversity. The railroads too are peculiarly exposed to the hazard of fire, flood, and earthquake, of extreme cold and parching drought, through which they often suffer enormous loss. The continuance of extraordinary profits always

causes the inflow of new capital in competition; even the most strongly entrenched railroad can not keep out a vigorous and persistent competitor; witness the entry of the Wabash interests into the City of Baltimore.

As a corporation is but a person in the eyes of the law, as its existence proceeds from and is maintained by the efforts of its individual members, it follows that its characteristics must be the same as the characteristics of individuals, although on a magnified scale. As an individual may be sagacious or reckless, so also may a corporation; as an individual may be thrifty or improvident, so also may a corporation; a corporation like an individual may be grasping, arrogant, tyrannical; but like an individual so surely as it may exert these qualities to the point of trespass, will it awaken antagonism that will beat it back into paths that do not encroach. As it often happens that a record of misbehavior in the past outweighs the creditable performance of a man in the present, so also does it happen that not only the practices of the buccaneers but the necessarily hard hitting of the pioneers of a previous generation overshadow the steadfastness of the pilots who to-day are endeavoring to steer in a narrowing channel. As it sometimes happens that the pecca-

dilloes of an orderly and upright family are exaggerated by neighborhood gossip into prime offenses, so it often is that lapses of its employes and the loose threads in its working are exploited for the condemnation of a corporation that is essentially upright and fair in its transactions and efficient in its performance. The functions of a scavenger, useful as they may be do not entitle him to formulate policies and mould legislation.

It must be remembered that certain corporations, a railroad company above all, must continue unceasingly in business. When it is hampered by political corruption that is tolerated by a municipality or a state, it cannot retire to the mountains and invoke the wrath of God upon the evildoers: it must meet the conditions as best it can and run its trains, even if to prevent such corruption from controlling the company it must control the corruption.

It must be remembered that those who administer political office, whether of the city, the state, or the nation are, like those who administer the railroads, of human mould and even the best of those in either field are not free from human ambition and human weakness. There are not only the tricks of the trade but the tricks of politics. When the political "striker" is opposed to the "magnate"

the battle unfortunately often embraces not only the homes, but the slums—upon which rest much of political power. The weapons that win in the immediate conflict are not always, either on the one side or the other, forged in reason and tempered with righteousness. The "boss" and his creatures have at least been as conspicuous as the "magnate" and his satellites, and both have been a force in our national life that there seems reason to hope is on the wane. The thrifty, the frugal, and the farsighted, whose investments in large measure are in the care of those who administer the railroads, are far outnumbered by those who spend as they earn. The railroad president attains his position by the votes of the stockholders; the authority of the government rests on the votes of the whole people. There has been manipulation in the one sphere as well as in the other. No one questions that the rights of the whole people must be safeguarded; but there is ever and ever the difficulty that even were every railroad president and director absolutely purged of every improper motive, his acts guided by consummate wisdom and the utmost knowledge of economic law, and were every man elected to governmental office a statesman pure and undefiled, there still would be the opportunity for endless friction arising out of

misunderstanding, the lack of perception of due relations, and of perspective, and of proportion. This is the besetting sin that the growth of popular intelligence alone will banish.

The transportation industry as embodied in the railroads was the first to produce the great modern corporation, and therefore the first to exemplify on a corporate scale the vices and virtues of its administrators. In a bygone day the railroad companies displayed the heady exuberance of youth; they took the hard knocks that have induced patient, strenuous and often self-denying maturity. As there are but comparatively few men who are essentially malicious, so also are there comparatively few corporations that are really predatory. The exploits of the few buccaneers that have not yet been dismantled are spectacular in the limelight that is cast upon them and obscure the perception of the host of able and upright railroad officials, than whom, by and large, from the top to the bottom rank there is no more hardworking, earnest, abstemious class of men on this earth.

If these lectures have done no more, it is to be hoped that they may have given some faint idea of the burdens that these men carry, of the problems that continually confront them, of the fact that the margin of profit of the railroads under the

best of conditions is so small that there would be no margin at all were it not for their skillful and persistent endeavor.

If the corporations are but individuals magnified, should they not only be held to the full accountability but be given the full rights of any other persons under the law? There should be provision for the prompt punishment of their crimes, for remedy for the abuses that spring from their action and prevention of their recurrence; but should they not also have the full benefit of their just achievements, and not be bound by such ill-judged legislation as is often proposed, which in repressing their activity, will hamper the well-being and retard the development of the nation?

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